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Basics in NURSING RESEARCH AND BIOSTATISTICS



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Foreword
K Reddemma



Basics in NURSING RESEARCH AND BIOSTATISTICS

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The Health Sciences Publisher
New Delhi | London

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UNIT

6

Research Approaches and Designs

A research approach or method is a general framework guiding the research study that includes broad assumptions, methods of data collection analysis, and interpretation. It depends upon the nature of the research problem being investigated. There are three basic methodologies or approaches used in any research, viz. qualitative, quantitative, or mixed methods.

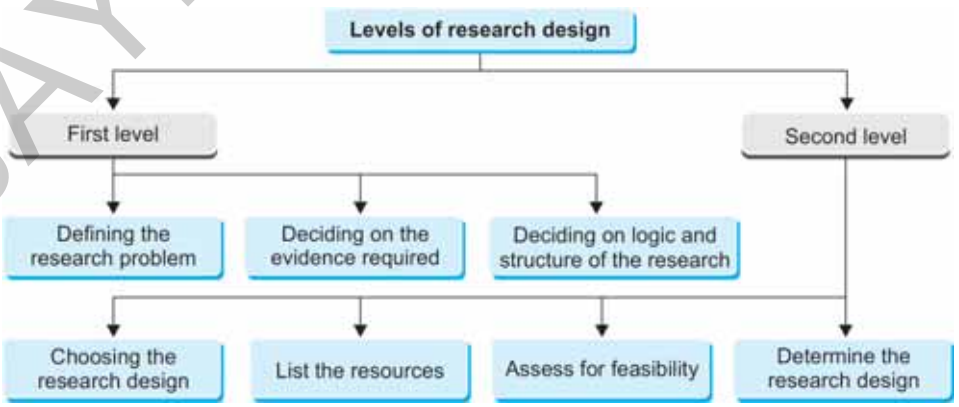
Research design is a specific outline detailing how chosen method or approach will be applied to answer a particular research question. It is a framework used for the planning, implementation and analysis of the research study intended to connect the conceptual research problem to the achievable empirical research. It has two levels. The first level is concerned with the decisions on what evidence is needed to answer the research problem. The second level concerns with methods of collecting evidence (what type of data, what method of data collection, what sampling strategy, and so on) (Flowchart 6.1).

MEANING AND DEFINITION

Research design is a blueprint or master plan specifying the methods and procedures for conducting a research study involving the description of research setting of the study, sample size, sampling technique, tools and methods of data collection, and analysis to answer specific research questions or test the research hypothesis.

On the whole, a research design is a plan to investigate a research problem covering description of all methods and materials that have a bearing on the quality of evidence the study yield.

Flowchart 6.1: Levels of research design



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A research design includes strategies and methods for data collection and analysis to meet the research purpose.

Research design is "a plan that describes how, when, and where data are to be collected and analyzed" (Parahoo, 1997).

PURPOSE OF A RESEARCH DESIGN

The main purpose of a research design is that it:

- Allows smooth implementation of various research processes, making research efficient with minimal outlay of resources.
- Guides the researcher in planning and implementing the study in a way to answering the research question.
- Helps the researcher to arrange the ideas in a systematic way so as to get a glimpse of flaws and inadequacies.
- Specifies the controlling mechanisms that will be used in the research study. The control provided by the design increases the probability that the study results are accurate reflection of reality.
- Provides a set of instructions to the researcher regarding study setting, sample size and techniques, time period, selection of variables, tools and methods of data collection, data analysis, and style of research report preparation.
- Research design has a great bearing on the reliability of the results arrived and constitutes a firm foundation for the entire structure of the research work. Preparation of research design should be done with great care as any error in it may upset the entire research process.

CHARACTERISTICS OF A QUANTITATIVE RESEARCH DESIGN

A quantitative research design must always build on previous findings. The main characteristics of a research design are presented in Figure 6.1.

- **Appropriateness to the research problem:** A research design should be appropriate to the research question and usually involve the consideration of the following factors: the methods of obtaining information, skills of the researcher and availability of time and money for research work.
- **Controls extraneous variables**: The best design should control extraneous variables, i.e. isolate the variables that are under the study from all other variables and measure them accurately, so that the collected data are reliable and valid.
- **Lack of bias**: It is an influence that produces a distortion in the study results. Bias can occur either during designing the research or selection of subjects or data collection or the analysis phase.

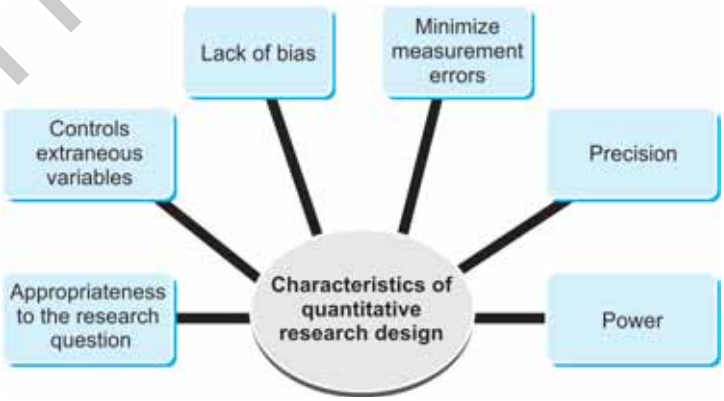


Fig. 6.1: Characteristics of quantitative research design

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Selection bias in quantitative research can be reduced by randomization and double-blind procedures while in qualitative research observer's bias can be reduced by triangulation method.

- **Minimize measurement errors**: The best design should minimize the measurement errors.
  - If the purpose of the study is to explore or discover the ideas and the insights, the design should be flexible enough to include the different aspects of the phenomenon.
  - If the purpose of the study is to describe the phenomena, the design should minimize bias and maximize the reliability of the evidence collected.
  - If the research study involves the testing of hypothesis of a causal relationship between variables, the design should permit inferences about causality in addition to the minimization of bias and maximization of reliability.
- **Precision**: In research design, precision refers to an ability to obtain the most accurate effect of treatment variable on an outcome variable. It can be achieved through the use of precise measuring tools and a design that controls over extraneous variables.
- **Power**: It is the ability of the research design to detect the relationship among variables. Power increases when a large sample is used.

CHARACTERISTICS OF A QUALITATIVE RESEARCH DESIGN

- Uses various data collection strategies
- Is flexible, rather than tightly predicted
- Takes place in natural setting
- Tends to be holistic, determined for an understanding of the whole
- Researcher becomes intensively involved
- Requires ongoing analysis of the data to formulate subsequent strategies and determine when data collection needs to be completed.

KEY ELEMENTS OF RESEARCH DESIGN

Research design describes methods and materials used to investigate the research study keeping in view the objectives of the research and availability of resources. The key elements of research design are presented in Figure 6.2.

- **Research problem**: The first step in the research process is the selection of research problem. It is also the most important step as the further steps depend on this selection of the problem. Hence, the research design should include a clear statement of the research problem.
- **Approaches and methods**: It should include research approaches (qualitative, quantitative, or both), description of population, subjects, sample, sampling techniques, variables, time duration, setting of the study, intervention, comparisons, controls for extraneous variables, communication with the subjects.
- **Data collection methods**: One of the elements of research design includes measures and methods used for gathering

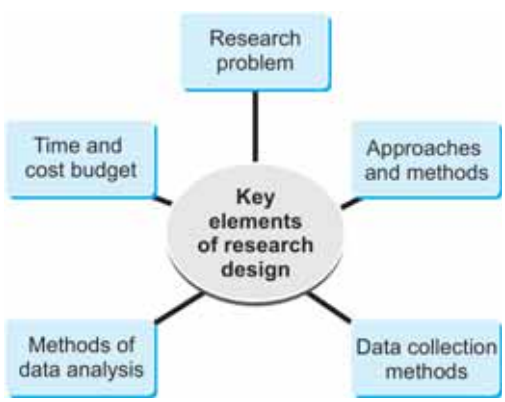


Fig. 6.2: Key elements of research design

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data. It comprises of tools and methods of data collection (questionnaire, observation, interview, etc.), time and location of data collection and study setting.

- **Methods of data analysis**: It must include a plan for data analysis and methods (quantitative or qualitative data analysis techniques) used in processing and analyzing the data.
- **Time and cost budgets**: The time and cost budgets are important components of research design as these are two of the constraints under which most research is done.

SELECTION OF RESEARCH DESIGN

A number of considerations influence the selection of research design. The researcher should select the most appropriate design to meet the objectives of the study. Selection of research design is influenced by several factors. Some of them are listed in Figure 6.3.

Current Knowledge of the Research Problem

- The choice of a research approach depends to a great extent on the nature of the research problem that has been identified. Quantitative approaches are appropriate when the purpose of the study is to find out the effect of an intervention (evaluating the effect of spiritual intervention on depression among cancer patients), test the relationship between the variables (correlation between well-being and spirituality among cancer patients), or describe a phenomenon with precision (determining the incidence of depression among fourth stage cancer patients).
- Qualitative approaches are appropriate when the purpose of the study is to understand the meaning of a phenomenon about which little is known (understanding the spiritual needs of end-stage cancer patients).
- A mixed method is appropriate when a combination of meaning and control is needed. Frequently, this method is used when a qualitative approach is used to design an instrument (development of spiritual needs assessment tool using qualitative interviews) or an intervention that is subsequently tested for effectiveness by using quantitative methods (assessment tool is used to measure the spiritual needs of cancer patients).

Knowledge and Experience of the Researcher

- Researchers' knowledge and experience play a key role in the selection of research approach. A researcher with scientific

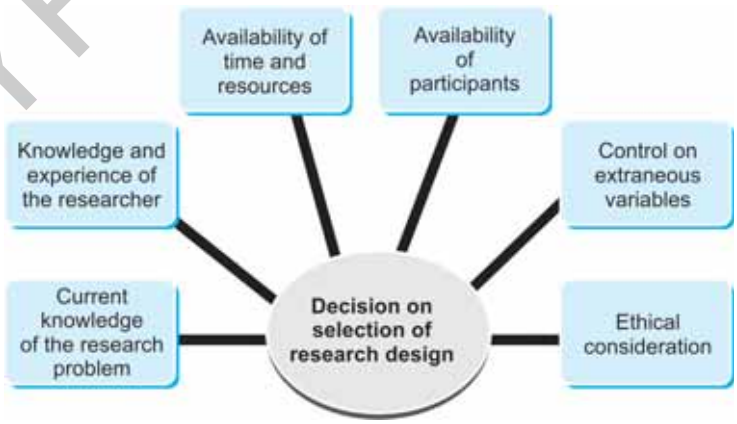


Fig. 6.3: Factors influencing the selection of research design

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knowledge, skillful in scientific writing, familiar with statistical packages, and quantitative journals would most likely select a quantitative design.

- On the other hand, a researcher efficient in conducting interviews, making close observations, and writing narrative descriptions prefers the qualitative approach.
- If the researcher is efficient in both qualitative and quantitative methods, he would prefer the mixed methods research.

Availability of Time and Resources

- Resources like equipment, facilities, and support from colleagues are important for conducting research. Availability of resources for a research study affects the selection of research design.
- Time is also an important factor in selection of a research design. For example, longitudinal studies require more time than cross-sectional studies do.

Availability of Participants

The selection of research design may be influenced by number and availability of study subjects. If only few subjects are available with specific characteristics, a qualitative research approach may be selected. On the other hand, if a large sample is available, the researcher can select quantitative research.

Control on Extraneous Variables

- An efficient design can maximize true results, decrease error, and control extraneous variables that may affect outcome. To get accurate results, the researcher should maximize control.
- The selection of research design is either true experimental or quasi-experimental based on the possibility of control over the extraneous variables. If control over the extraneous variables is possible, true experimental designs can be chosen. However, if the researcher is unable to control the selected extraneous variables, quasi-experimental designs can be selected.

Ethical Considerations

- These include respect for participants, informed consent, and protection from harm.
- The consideration of ethics may affect the selection between an experimental design and a nonexperimental design.

DECISION ON SELECTION OF RESEARCH DESIGN

- Make a written list of the pros and cons of each design
- Balance the factors involving time, cost, ethical issues, and integrity of the study
- Anticipate alternative research findings and consider whether design adjustments might affect the results
- Seek the advice of research experts
- Write out a rationale for design decisions

TYPES OF RESEARCH DESIGNS

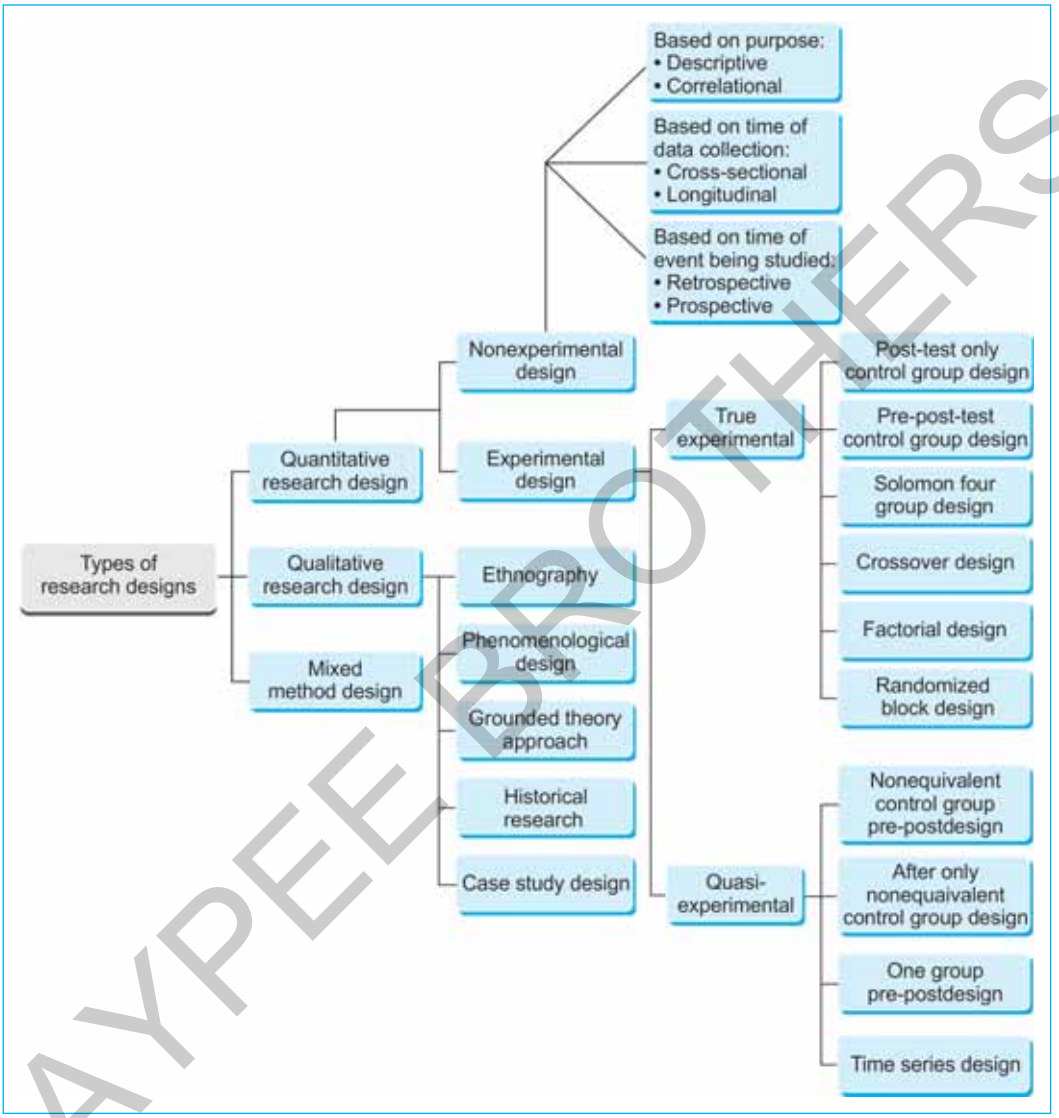
Different types of research designs cater to different types of questions or hypothesis. They are often classified as quantitative or qualitative or mixed designs. Various types of research designs are presented in Flowchart 6.2.

Quantitative Research Designs

- Quantitative research designs rely on the postpositivist paradigm philosophy. This philosophy believes that causes probably determine the effects or outcomes and emphasizes on developing and testing of theories.
- Postpositivists normally use deductive reasoning approach to examine the cause and their influence on the outcome. In deductive reasoning approach, the researcher selects the theory or framework where concepts have already been

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Flowchart 6.2: Types of research designs

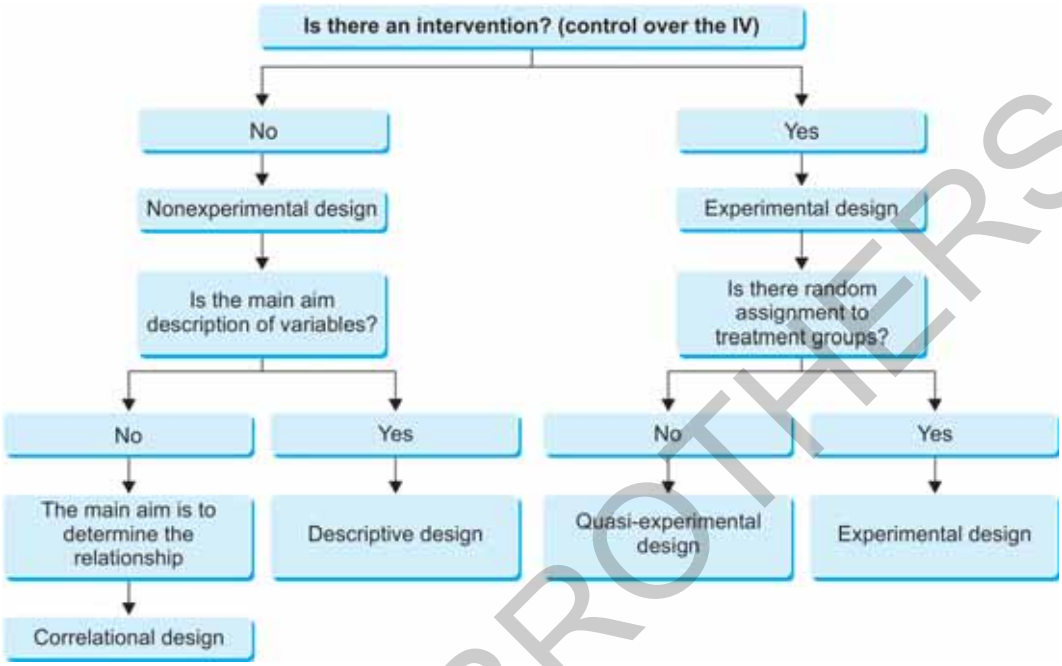


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reduced to variables. These variables are then tested to support the theory.

- Quantitative research is designed to collect numerical data, which can be transformed to usable statistics for answering research question or hypothesis.
- Quantitative research designs are well structured and specify the research methodology in detail which includes sample characteristics and selection, setting, nature of intervention, tools to measure the variables, methods used to control extraneous variables, time and type of data collection, methods used for data collection, and information to be shared with the participants.

Flowchart 6.3: Schematic diagram depicting the selection process in research design



Types of Quantitative Research Designs

A variety of research designs are used in nursing research, which are categorized differently by different authors. According to Dickoff and James (1968), the four most commonly used types are: (1) descriptive, (2) correlational, (3) quasi-experimental, and (4) experimental research designs. While descriptive and correlational designs are referred to as nonexperimental designs, quasi-experimental, and true experimental research designs are referred to as experimental designs. Flowchart 6.3 helps in the selection process of research design.

NONEXPERIMENTAL DESIGNS

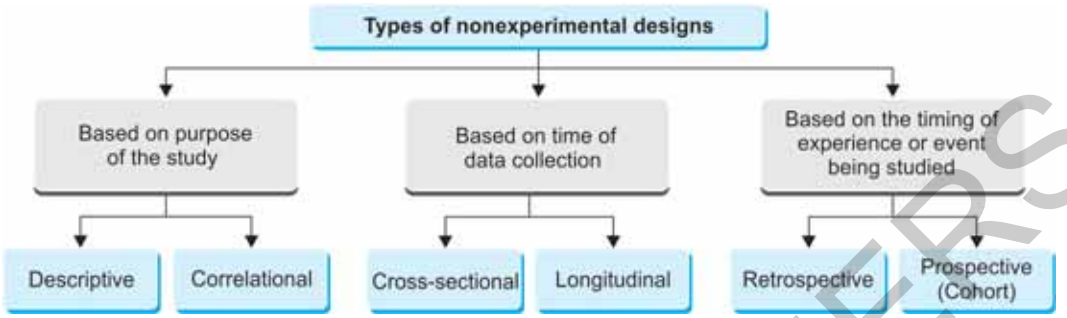
- Nonexperimental designs focus on examining variables, as they naturally occur in the environment and not on the implementation of a treatment by the researcher.
- Nonexperimental designs describe, differentiate, or examine associations among the variables.
- These designs do not use control groups, manipulation of independent variable, or random assignment of sample to the groups, as it only employs observation.
- This type of research is also a rich source of data that helps the researcher to formulate questions for use in experimental or quasi-experimental designs.

Reasons for undertaking nonexperimental designs

- In many instances, some variables are not amenable to experimental manipulation or randomization (height or gender).
- In some instances, no control over the independent variables is possible as they have already occurred.

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Flowchart 6.4: Types of nonexperimental designs



- At times, there are practical constrains or ethical considerations to manipulate variables.
- To get a realistic understanding of the phenomena as it exists in the natural setting, the researcher deliberately chooses not to manipulate the variables.

Types of nonexperimental designs: The three basic categories of nonexperimental designs are presented in Flowchart 6.4.

Classification based on purpose of the study: Based on the purpose of the study, non-experimental designs can be classified into either descriptive or correlational.

1. DESCRIPTIVE OR EXPLORATIVE DESIGNS

The main aim of descriptive research is the accurate depiction of individual characteristics, events, or groups and the frequency of occurrence of phenomena using statistics to describe and summarize the data (Polit and Hungler, 2013).

The purpose of descriptive research is the exploration and description of phenomenon in real life situations. It describes what actually exists, determines the frequency of occurrence, and categorizes the information. Instruments used to obtain data in descriptive studies include questionnaires, interviews (closed questions), and observations (checklists, etc.). Sample subjects are chosen who represent the population at large. No attempt is made to explain or predict what the situation might be in future or how it might change. In a descriptive design, bias can be controlled through:

- Conceptual and operational definitions of variables
- Sample selection and size
- Use of valid and reliable instruments
- Following appropriate procedure in data collection

Purposes

- These designs are used to develop theories, identify problems and trends in illness
- Explore new areas of research
- Describe situations as they exist in the world
- Provide knowledge base for other types of quantitative research methods

Thus, descriptive studies can provide valuable evidence regarding disease prevalence, nature, and intensity. In nursing, the only way to understand the beliefs and values of different individuals and groups is by describing them. This descriptive knowledge helps in developing nursing interventions that benefit individuals, families, or groups so as to obtain desirable and predictable outcomes.

Advantages

- More flexible and broad in scope
- Can focus on range of topics and also applicable to any population

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- Great deal of information can be obtained from a larger population
- Its methodology can be explicitly stated making it easier to evaluate and replicate

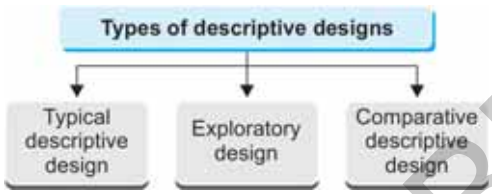
Disadvantages

- Collected information is superficial. The breadth rather than depth of information is emphasized.
- Large-scale studies are time consuming and costly.

Types of Descriptive Designs

Descriptive designs can be classified into typical descriptive, exploratory, and comparative descriptive designs (Flowchart 6.5).

Flowchart 6.5: Types of descriptive design



- *Typical descriptive design*: This design is used to examine variables in a single sample, which includes identifying the variables, measuring the variables, and describing them. Schematic presentation of typical descriptive design is presented in Figure 6.4.
  Example: A study to assess the pain experiences among patients with rheumatoid arthritis. In this study, the researcher describes the intensity and frequency of pain among patients.
- *Exploratory design*: This design is used to explore related factors of the existing phenomenon in order to enhance the understanding of the less understood phenomena. This includes identifying the variables and related factors, measuring frequency of occurrence and describing them with an in-depth explanation. Schematic presentation of exploratory design is presented in Figure 6.5.
  Example: An explorative study to assess various factors associated with pain and coping measures among patients with rheumatoid arthritis. In this study, the researcher may describe various factors associated with pain and related coping mechanisms, measure those factors and provide an in-depth explanation.
- *Comparative descriptive design*: In this design, two or more groups are compared on the basis of selected variables. This includes measuring the differences in variables occurring naturally between the two or more groups and comparing them on selected variables. Schematic presentation of comparative descriptive design is presented in Figure 6.6.
  Example: A comparative study on pain symptoms among male and female patients suffering with rheumatoid arthritis.

2. CORRELATIONAL DESIGNS

It involves the analysis of two variables to describe the strength and direction of the relationship between them. These studies are used to answer questions about relationships or associations. Correlational research assesses the inter-relationships among study variables without any active intervention by the researcher (Polit and Hungler, 2013).

- These designs are used to examine relationships between or among, two or more variables in a single group without any intervention.

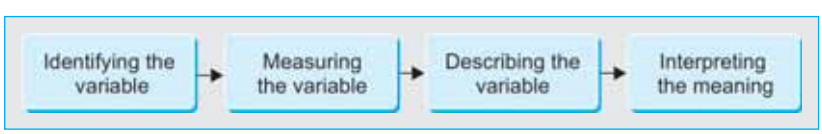


Fig. 6.4: Schematic presentation of typical descriptive designs

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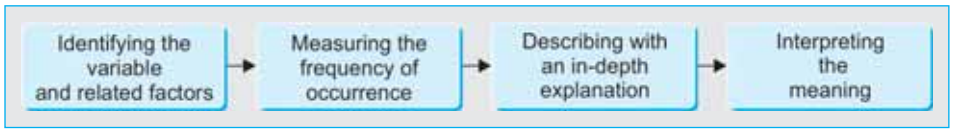


Fig. 6.5: Schematic presentation of exploratory design

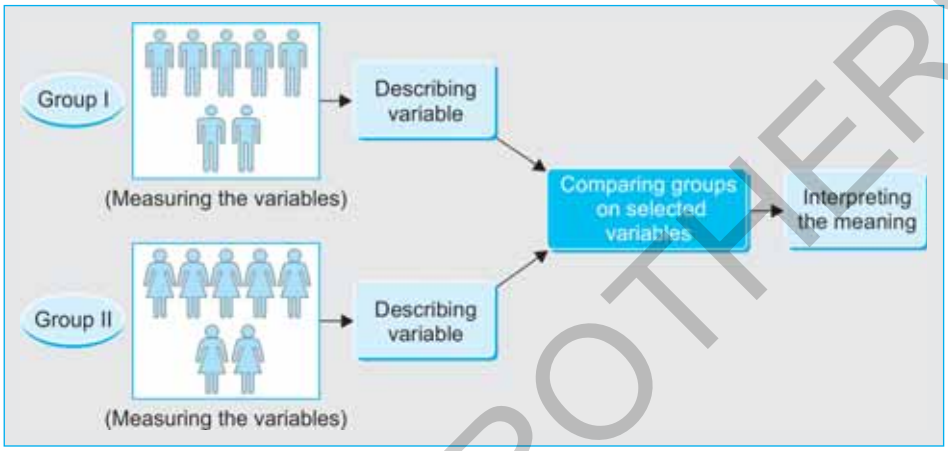


Fig. 6.6: Schematic presentation of comparative descriptive design

- Correlational designs are usually cross-sectional.

Purposes

- These designs study whether changes in one or more variables are related to changes in another variable (covariance).
- Correlations assess direction and degree (magnitude and strength) of the relationships, or associations among variables.
- Hypotheses are generated from correlational study results, which are tested by quasi-experimental and true experimental studies.

Advantages

- Efficient means of collecting a large amount of data about a problem and discover a large number of inter-relationships in a relatively short period of time.
- Correlational research usually takes place in a natural setting and thus better suited to solve practical problems in everyday life.
- Relatively uncomplicated to plan and implement.
- The researcher has the flexibility in exploring the relationships among variables.
- Demonstrates strength and direction of a relationship between the variables, which helps the researcher to narrow down on the findings and determine cause-and-effect relationship by conducting experimental studies.

Disadvantages

- These studies lack randomization and control between the variables. Thus they are susceptible to faulty interpretation of relationships.
- As correlation research only uncovers a relationship and cannot manipulate variables of interest, causality cannot be established, i.e. it cannot provide a conclusive reason for why there is a relationship.

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REVIEW QUESTIONS

I. Long Essays

1. Define research design. Explain characteristics of research design.
2. Write the classification of research design. Discuss advantages and disadvantages of experimental research.
3. What is qualitative research design? List out the types and explain any one type with an example.
4. Differentiate between qualitative and quantitative research designs.
5. List various nonexperimental research designs. Explain correlational research designs with examples.
6. List various quasi-experimental designs. Describe its advantages and disadvantages.

II. Short Essays

1. Explain characteristics of true experimental research design.
2. What are the factors to be considered while selecting research methods?
3. Explain descriptive research designs.
4. Differentiate between experimental and nonexperimental research design.
5. Explain in detail about retrospective and prospective designs.
6. What are epidemiological research designs and briefly explain the types?
7. Explain the types of true experimental research design.
8. Narrate survey methods.

III. Short Answers

1. Threats to internal validity
2. Threats to external validity
3. Survey studies
4. Hawthorne effect
5. Observational studies
6. Design
7. Cross-sectional designs
8. Attrition
9. Manipulation
10. Randomization
11. Control

IV. Multiple Choice Questions

1. Blueprint of research work is called
   a. Research problem
   b. Research design
   c. Research tools
   d. Research methods
2. Research design involves description of
   a. Research approach
   b. Setting of the study
   c. Sample size
   d. All of these
3. Which research paradigm is least concerned about generalizing its findings?
   a. Quantitative research
   b. Qualitative research
   c. Mixed research
   d. None of the above
4. What is the key defining characteristic of experimental research?
   a. Extraneous variables are never present
   b. A positive correlation usually exists
   c. A negative correlation usually exists
   d. Manipulation of the independent variable
5. Which of the following best describes quantitative research?
   a. The collection of non-numerical data
   b. An attempt to test the researcher's hypotheses

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c. Study participants will be easily available
d. Conducting the study will be easy

29. Case studies may concern an in-depth examination of
a. Individuals
b. Group of people
c. Institutions
d. All of the above

30. Which of the following designs controls for the sensitization of subjects to a pretest?
a. Pretest–posttest control group design
b. Solomon four-group design
c. Case study
d. Posttest only control group design

31. Which research is a study of past records and other information source?
a. Fundamental research
b. Applied research
c. Historical research
d. Basic research

32. ..... involves the collection and analysis of the culture of a group.
a. Phenomenological research
b. Ethnographical research
c. Grounded theory
d. Historical research

ANSWER KEY

1. b	2. d	3. b	4. d	5.b	6. a
7. c	8. a	9. c	10. b	11. d	12. c
13. d	14. c	15. b	16. b	17. b	18. d
19. c	20. b	21. d	22. c	23. a	24. b
25. b	26. a	27. b	28. a	29. d	30. b
31. c	32. b				

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