# RESEARCH METHODOLOGY FOR EFFECTIVENESS OF TEACHERS IN RELATION TO TEACHING COMPETENCY

Prof. (Dr.) Vinodkumar Satyapal (Guide)[*]
Dr. Tirtha Kanti Karmakar (Co-Guide)[**]
Desai Nimisha Bavchandbhai[***]

## ABSTRACT

*Research involves planning the research design, structure, and investigation strategy to answer research questions. The researcher's primary responsibility is to create a research design that provides the necessary information to solve the problem, outlining data collection, measurement, and analysis. Research is the pursuit of knowledge, involving a scientific and systematic investigation to gather relevant information on a specific topic. According to Webster's Dictionary, research involves a careful and diligent search, a thorough investigation, experimentation, and the discovery and interpretation of findings. It includes revising broad practical or pragmatic viewpoints based on these findings. This paper outlines the processes and procedures followed in conducting the study according to its objectives. It defines the population characteristics and describes the sampling techniques used. It also details the research instruments, data collection procedures, and statistical methods used for analysis.*

***Keywords:*** *Research Design, Investigation Strategy, Sampling Techniques, Statistical Methods.*

_____

## Introduction

In research methodology, a researcher systematically explores the question and seeks answers until reaching a conclusion. Without a systematic approach, it is challenging to arrive at definitive results. Researchers face many challenges when exploring research questions, which can be effectively addressed using the right research methodology (Industrial Research Institute - 2010).

In essence, the research strategy defines how the research objectives will be achieved and how any problems encountered will be addressed. Data is fundamental to any research, acting as the raw material for the study. To collect data, the researcher must establish a design, describe the sampling method, population and sample, data collection instruments, and the reliability and validity of these instruments. The collected data is then tabulated.

## Research Design

One of the primary challenges following the definition of a research problem is preparing the research design, a crucial mapping strategy based on sampling techniques. This design encompasses objectives, sampling methods, research strategies, tools and techniques for collecting evidence, data analysis, and reporting findings. Essentially, the research design outlines the purpose of the investigation and the methods to achieve a satisfactory conclusion. It involves extensive planning before the actual project begins.

[*]     Professor, School of Education, Sabarmati University, Ahmedabad, Gujarat, India.
[**]    Assistant Professor, School of Education, Sabarmati University, Ahmedabad, Gujarat, India.
[***]   Research Scholar, School of Education, Sabarmati University, Ahmedabad, Gujarat, India.

The creation of a research design involves selecting the type of research (experimental, survey, exploratory, quasi-experimental, or review) and its sub-types. The design phase includes three main components: data collection, measurement, and data analysis. The nature of the research problem dictates the design, which in turn determines the tools and methodologies used.

Conceptually, research design is the blueprint for conducting research, covering everything from hypothesis formulation to data analysis. Its aim is to provide maximum relevant information about the research problem with minimal cost. Effective research design involves planning the methods for data collection and analysis, considering the research objectives, and the available resources (staff, money, and time).

Key elements of research design include:

- A precise statement of objectives
- Techniques for data collection and analysis
- Methods for analyzing collected data
- Type of research methodology
- Potential objections to the research
- Setting for the study
- Timeline
- Measurement of analysis

A robust research design features characteristics like neutrality, reliability, validity, and generalization. Neutrality ensures unbiased and neutral results, while reliability ensures consistent results across repeated studies. Validity involves using appropriate measurement tools to achieve research objectives, and generalization ensures the applicability of results to the broader population.

The benefits of a well-designed research plan include clarity of research objectives, increased validity and reliability, improved data collection and analysis, better communication of results, and efficient use of resources.

**Data Collection Methods**

Data collection is a critical aspect of any research, ensuring that the information gathered is accurate, relevant, and useful for achieving the study's objectives. There are two primary methods for data collection: primary data collection and secondary data collection.

**Primary Data Collection**

Primary data collection involves gathering new data directly from original sources. This method is essential when the information required is specific to the study and not available from existing sources. Various techniques are employed to collect primary data, each suited to different types of research and objectives.

- **Surveys and Questionnaires:** Surveys are one of the most common methods of primary data collection. Researchers design questionnaires with structured questions to gather information from respondents. These surveys can be administered in person, by phone, online, or through the mail. Surveys are particularly useful for collecting quantitative data and understanding the opinions, behaviors, and characteristics of a population.

- **Interviews:** Interviews involve direct, face-to-face, telephonic, or virtual conversations between the researcher and respondents. This method allows for in-depth data collection and is ideal for exploring complex issues. Interviews can be structured, semi-structured, or unstructured, depending on the research objectives.

- **Observations:** Direct observation involves systematically watching and recording behaviors and events as they occur in their natural setting. This method is widely used in fields like anthropology, sociology, and ecology. Observations can provide valuable qualitative data and insights into real-world behaviors and interactions.

- **Experiments:** Experimental research involves manipulating one or more variables to observe their effect on other variables. This method is commonly used in scientific and psychological research. Experiments can provide strong evidence of causal relationships but require careful planning and control to ensure valid results.

- **Ethnographic Research:** This method involves immersing oneself in a community or culture to gain a deep understanding of its practices, beliefs, and social dynamics. Ethnographic research often requires prolonged engagement and participant observation, providing rich qualitative data.

**Secondary Data Collection**

Secondary data collection involves using existing data that has been collected by other researchers or organizations. This method is cost-effective and time-saving, as it leverages previously gathered information. Secondary data can be sourced from various places, including:

- **Administrative Records:** Government agencies, organizations, and institutions maintain records and databases that can be valuable sources of secondary data. Examples include census data, tax records, healthcare records, and educational records. These sources often contain comprehensive and reliable information.

- **Literature Reviews:** Reviewing existing literature, including academic journals, books, and conference papers, provides valuable insights into the current state of research on a topic. Literature reviews help identify gaps in knowledge and provide a context for new research.

- **Online Databases:** Numerous online databases offer access to a vast array of secondary data. These databases include academic repositories, statistical databases, and data archives. Researchers can use these sources to find relevant data for their studies.

- **Social Media and Web Data:** Analyzing data generated from social media platforms, websites, and online communities can provide insights into digital populations and online behaviors. This method is particularly useful for studying trends, opinions, and interactions in the digital age.

- **Remote Sensing:** Remote sensing technologies, such as satellites and drones, collect data about environmental features and phenomena. This method is beneficial for studying large geographic areas or inaccessible locations, providing detailed and accurate information.

**Sampling Techniques**

Sampling is a fundamental aspect of research methodology, allowing researchers to gather data from a subset of a population to make inferences about the entire population. It is crucial for managing resources efficiently and ensuring that the research findings are valid and generalizable. There are two primary types of sampling techniques: probability sampling and non-probability sampling.

**Population and Sample**

Defining the population and selecting an appropriate sample are critical steps in any research study. The population refers to the entire group of individuals, objects, or events that share specific characteristics of interest to the researcher. It represents the larger group from which the sample is drawn and to which the research findings will be generalized. For example, in a study examining the dietary habits of adults in a particular country, the population would include all adults residing in that country.

The sample is a subset of the population selected for the actual study. It is crucial that the sample accurately represents the population to ensure that the research findings are valid and can be generalized. In research, the goal is often to make inferences about the population based on the sample, making the selection process critical. The process of defining the population involves clearly specifying the criteria that determine which individuals or objects are included in the study. This could be based on demographic factors, geographic location, specific behaviors, or other relevant characteristics. Once the population is defined, the next step is to develop a sampling frame, which is a list or source from which the sample will be drawn. The sampling frame should include all elements of the population and be accessible for sampling.

**Sampling Procedure**

The sampling procedure involves several critical steps to ensure that the selected sample accurately represents the population and provides reliable data for the study. The first step in the sampling procedure is to define the population clearly. This involves specifying the characteristics that determine inclusion in the study, ensuring that the population is homogeneous in terms of the variables being studied. For the present study, the population is defined as secondary school teachers in the state of Gujarat, specifically those teaching in Gujarati medium and English medium schools at the class X level.

**Data Analysis**

Data analysis is a critical phase in the research process, where raw data collected through various methods is systematically examined to extract meaningful insights and conclusions. The objective of data analysis is to transform raw data into useful information, facilitating decision-making and supporting the research hypotheses or objectives. This process involves several steps, including data cleaning, data transformation, statistical analysis, and interpretation of results. Data cleaning is the first step in data analysis, ensuring the accuracy and completeness of the data. This step involves identifying and correcting errors, such as missing values, outliers, and inconsistencies. Cleaning the data is essential to avoid biased results and ensure the reliability of the analysis. For instance, if a survey response is incomplete or contains erroneous information, it needs to be addressed before proceeding with further analysis. Techniques such as imputation for missing values or exclusion of outliers are commonly employed during this stage.

Once the data is cleaned, the next step is data transformation. This process involves converting data into a suitable format for analysis. Transformation techniques include normalization, aggregation, and categorization of data. Normalization ensures that data from different sources is brought to a common scale, making it easier to compare and analyze. Aggregation involves summarizing detailed data into broader categories, while categorization helps in grouping data based on specific criteria, facilitating a more structured analysis. Statistical analysis is the core of the data analysis process. This involves applying various statistical methods and techniques to analyze the data and test the research hypotheses. Descriptive statistics, such as mean, median, mode, standard deviation, and variance, provide a summary of the data, offering insights into its central tendency and dispersion. These measures help in understanding the overall pattern and distribution of the data.

Inferential statistics are used to draw conclusions and make inferences about the population based on the sample data. Techniques such as t-tests, chi-square tests, ANOVA (Analysis of Variance), and regression analysis are commonly used to test hypotheses and determine relationships between variables. For instance, a t-test can compare the means of two groups to determine if they are statistically different, while regression analysis can identify the strength and nature of the relationship between dependent and independent variables.

Advanced statistical techniques, such as factor analysis, cluster analysis, and multivariate analysis, are used for more complex data sets. Factor analysis helps in identifying underlying factors or constructs that explain the pattern of correlations within the data. Cluster analysis groups similar data points into clusters, aiding in the segmentation and identification of patterns. Multivariate analysis examines multiple variables simultaneously to understand their interrelationships and combined effect on the outcome.

The final step in data analysis is the interpretation of results. This involves explaining the statistical findings in the context of the research objectives and hypotheses. Interpretation requires a deep understanding of both the statistical results and the subject matter of the research. The aim is to draw meaningful conclusions that can inform decisions, support theories, or guide future research. For example, if a regression analysis shows a significant relationship between marketing spend and sales, it suggests that increasing marketing efforts could lead to higher sales.

**ANOVA and MANOVA**

Analysis of Variance (ANOVA) and Multivariate Analysis of Variance (MANOVA) are used to compare means across multiple groups. ANOVA tests whether there are significant differences between the means of three or more groups, while MANOVA extends this to multiple dependent variables. These techniques are useful for studies involving experimental designs where the researcher wants to assess the impact of different treatments or conditions. For instance, ANOVA might be used to compare the test scores of students taught using different teaching methods to determine if one method is superior.

**Interpretation and Reporting**

The final step in quantitative analysis is interpreting the results and reporting the findings. This involves explaining the statistical outcomes in the context of the research questions and hypotheses. Researchers must consider the practical significance of the results, not just their statistical significance, and discuss potential limitations and biases that might affect the conclusions. Clear and concise reporting, often accompanied by tables, graphs, and charts, helps convey the findings effectively to stakeholders, ensuring that the insights gained can inform decision-making and future research.

**Tools and Instruments**

Quantitative analysis relies heavily on various tools and instruments to collect, organize, analyze, and interpret data. These tools and instruments enhance the accuracy, efficiency, and effectiveness of the research process. Some of the most widely used tools in quantitative analysis include SPSS, Excel, R, Python, and other specialized software and instruments.

- **SPSS (Statistical Package for the Social Sciences):** SPSS is one of the most popular tools for statistical analysis in social sciences and other fields. It provides a comprehensive suite of tools for data management, statistical analysis, and graphical representation. SPSS is user-friendly, with a menu-driven interface that allows researchers to perform complex analyses without extensive programming knowledge. Key features of SPSS include descriptive statistics, cross-tabulation, regression analysis, ANOVA, factor analysis, and cluster analysis. SPSS also offers advanced data manipulation capabilities, such as data transformation and recoding, making it a versatile tool for quantitative research.

- **Excel:** Microsoft Excel is a widely accessible and versatile tool for data analysis. While it is primarily known as a spreadsheet application, Excel includes a range of features for statistical analysis. Researchers can use Excel to organize data, perform basic statistical tests, create charts and graphs, and conduct data visualization. Excel's functionalities can be extended with add-ins like Analysis ToolPak, which provides additional statistical tools such as regression analysis, t-tests, and ANOVA. Excel is particularly useful for exploratory data analysis and for researchers who need to handle large datasets and perform preliminary analyses before moving on to more specialized software.

In summary, a wide range of tools and instruments are available for quantitative analysis, each with its strengths and applications. The choice of tools depends on the specific needs of the research, the complexity of the analysis, and the researcher's familiarity with the software. By leveraging these tools effectively, researchers can enhance the accuracy, efficiency, and impact of their quantitative studies.

**Ethical Considerations**

Ethical considerations are fundamental to conducting research, ensuring the integrity of the research process and the protection of participants. These considerations encompass a broad range of issues, from obtaining informed consent to ensuring the confidentiality and privacy of participants. Ethical research practices are essential for maintaining public trust, upholding the rights and welfare of participants, and ensuring the validity and credibility of research findings.

**Transparency and Integrity**

Transparency and integrity in research involve being honest and open about the research process and findings. Researchers should provide accurate information about the purpose of the study, the methods used, and the results obtained. This includes disclosing any potential conflicts of interest that might influence the research. Fabricating, falsifying, or misrepresenting data is unethical and undermines the credibility of the research. Researchers must adhere to ethical standards and guidelines established by professional organizations and institutions to maintain the trustworthiness of their work.

**Beneficence and Justice**

The principles of beneficence and justice are central to ethical research. Beneficence involves maximizing the potential benefits of the research while minimizing harm to participants. Justice refers to the fair and equitable treatment of all participants, ensuring that the burdens and benefits of research are distributed fairly. This includes ensuring that no group is unfairly burdened or excluded from the potential benefits of research. For example, if a study aims to understand a health issue prevalent in a particular community, it is essential that the community benefits from the research findings.

**Ethical Review and Approval**

Before conducting a study, researchers must seek approval from an institutional review board (IRB) or ethics committee. These bodies review the research proposal to ensure that it complies with ethical standards and guidelines. The review process involves evaluating the study's design, potential risks and benefits, informed consent procedures, and plans for protecting confidentiality. Obtaining ethical approval is a critical step in the research process, providing an independent assessment of the study's ethical considerations and safeguarding participants' rights and welfare.

**Ethical Use of Data**

Once data is collected, researchers must ensure that it is used ethically. This involves using the data only for the purposes outlined in the informed consent process and not for any unauthorized or unintended purposes. Data should be stored securely and shared only with individuals who have legitimate access. Researchers must also consider the ethical implications of data analysis and interpretation, avoiding practices that might misrepresent or mislead.

**Summary of Methodology**

The methodology of this study outlines the systematic approach employed to investigate the research questions and achieve the study's objectives. The methodology encompasses the research design, data collection methods, sampling techniques, data analysis procedures, and ethical considerations. Each component is meticulously planned to ensure the reliability and validity of the findings, providing a robust framework for the research process. This study adopts a descriptive research design, specifically utilizing the survey method to gather data from participants. The survey method is chosen for its effectiveness in collecting a large amount of data from a diverse population, allowing for comprehensive analysis of trends and relationships within the data. The research design is structured to ensure that the study's objectives are met systematically, starting from the formulation of research questions to the analysis and interpretation of data.

**References**

1.	Anderson, L.W. (1991) Increasing Teacher Effectiveness. Paris: UNESCO; International Council for Educational Planning.
2.	Das, B.C. (2005) Sense of Accountability among Teachers. Edutracks, 5(3), 21-22.
3.	Grewal, S.S. (1976) Intellectual and Personality Correlates of Teacher Effectiveness at the Higher Secondary School State, Ph.D. Thesis in Education, Punjab University, Chandigarh.
4.	Rao, K. Ganes Wara (1995) A Study of Teacher Effectiveness in relation to Creativity and Interpersonal Relationships, Ph.D. Thesis in Education, Andhra, University, Andhra Pradesh.
5.	Samad, A. (1986) A Study of Organizational Climate of Government High Schools Chandigarh and Its Effect on Job Satisfaction of Teachers (Unpublished) Ph.D. Thesis in Education, Panjab University, Chandigarh.
6.	Wilhelm, J.D. (1996) Teacher Effectiveness in a community college: Student and Teacher Perceptions. Dissertation Abstract International, 57(03), 1103.

❖◆❖