The Scientific Method

When dealing with science, everyone is supposed to follow certain rules and processes to make it a reliable source of information. Sciences are built up. It depends on observation, measurement, prediction, experimentation, or verification, thus differentiating science from other fields of knowledge. The scientific method is based on evidences rather than beliefs or arguments. This character distinguishes science from faith or authority. The scientific method is often described as comprising the following main actions:

- Make observations or gather information
- Develop a hypothesis
- Predict results
- Design an experiment
- Conduct the experiment and collect data
- Evaluation and conclusion
- Acceptance, modification, or rejection of the hypothesis.

Research Methodology and Research Methods

We often use the terms research methods and research methodology. *Research methods* mean the methods and procedures a researcher employs to accomplish a research task. Research methods provide precise and detailed procedures of how to start, implement, and complete a research project. These include the research techniques, data collection methods, statistical techniques for the analysis of data, evaluation of research results, etc. At the same time, research methodology is used in a wider perspective. *Research methodology* deals with the general approaches or guidelines for conducting research. It is the science and philosophy behind research methods. Research methodology can be defined as the systematic study of the research process starting from the planning process to reporting the results. 'Research methods' constitute only a part of the wider field of 'research methodology'.

Research methods are more important during the implementation phase of a research project or experiment, whereas, research methodology is relevant from the planning stage itself. For a researcher, there are many methods and techniques, which can be selected for completing the tasks. The researcher should know not only the theory and practice of these methods or techniques but also needs to know which of these methods are relevant and how these are selected. In other words, research methodology is about the research methods and the logic

behind in selecting a particular method and how the researcher proceeds and concludes the research project. Research methodology encompasses the strategies we use during planning, implementation, and reporting stages of a research project. Certainly, writing research reports and speaking about research are also part of the wider field of research methodology.

The difference between research methods and research methodology

The terms **research methods** and **research methodology** are often used interchangeably, but they have distinct meanings in the context of research. Here is a breakdown of the differences:

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1. Research Methods

Research methods refer to the **specific techniques and procedures** used to collect and analyze data in a study. These are the practical tools and strategies that researchers use to conduct their investigation.

- **Key Features**:
    - Focuses on how the research is conducted.
    - Includes tools like surveys, experiments, interviews, observations, and statistical analysis.
    - Examples:
        - A **quantitative method** like administering a structured survey.
        - A **qualitative method** like conducting in-depth interviews.
- **Questions It Addresses**:
    - What tools or techniques will be used to gather data?
    - How will the data be analyzed?

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2. Research Methodology

Research methodology refers to the **theoretical framework and overall approach** guiding a research study. It is the rationale behind the use of certain research methods and helps explain *why* certain methods are chosen.

- **Key Features**:
    - Focuses on the underlying philosophy and justification for the research approach.
    - Involves the study of research methods themselves and their appropriateness for achieving the study's objectives.
    - Examples:
        - Deciding between a **positivist methodology** (favoring quantitative methods) or an **interpretivist methodology** (favoring qualitative methods).
- **Questions It Addresses**:
    - Why is a particular method or approach suitable for this study?
    - What are the philosophical assumptions (e.g., epistemology, ontology) underpinning the research?

In Summary

Aspect	**Research Methods**	**Research Methodology**
Definition	Specific techniques for data collection and analysis.	Theoretical approach to the research process.
Focus	Practical execution of research.	Justification and rationale for methods used.
Nature	Technical and procedural.	Philosophical and conceptual.
Examples	Surveys, experiments, interviews.	Positivism, interpretivism, mixed methods.

Both concepts are integral to a robust research design: **methods** describe the *how*, while **methodology** explains the *why*.

Les deux concepts font partie intégrante d'une conception de recherche robuste : les méthodes décrivent le comment, tandis que la méthodologie explique le pourquoi.

The Research Process

The research process starts from identifying a research problem and completes by the publication of research results. It often begins from an idea or from an unsolved problem. It can also be a continuation of previous research done by the researcher or others. Identifying the problem and comparing it with similar ones is the first task. If this step is successfully completed, then you have to get the approval of concerned authorities to proceed with it. This step is crucial as the research requires funding, and funds would be released only if it is approved by the competent authorities. The authorities approve the projects based on the merit of the problem. After getting necessary approval and funding, you may proceed with it by selecting and applying the most appropriate research methods. You have to exercise extreme caution and vigil during this step because a wrong decision can ruin the entire effort. Once the

Research work is completed, the next step is to analyse the data you have gathered, and come out with definite conclusions. If you have succeeded in solving the problem, you should inform others, especially those who have some interest or stake in the problem, about your findings and how you have solved the problem. In other words, it is the duty of the researcher to prepare a report of the results and communicate it in a proper way. A research student first executes this in the form of a dissertation or thesis, and then as research papers or presentations in symposia or conferences. All the activities mentioned above form part of the research process. In short, the research process consists of a series of steps necessary to carry out the research effectively. It consists of closely related but often overlapped activities. At each operational step in the research process, the researcher chooses from a basket of methods, procedures, techniques, or models to accomplish the research objectives. For the smooth flow of the research process and its successful completion, a thorough knowledge on various tenets of research methodology is crucial. The following are the important steps in the research process.

1. Identify the research problem

2. Review of literature

3. Develop the objectives

4. Decide the research design

5. Formulate the research protocol

6. Get approval from competent authorities

7. Conduct the research work and collect data

8. Analysis of data

9. Interpretation of data

10. Preparation of the thesis/report

11. Presentation of results

12. Publication of reports.

By understanding what research is, how it is conducted, and why it is essential, you can appreciate the role it plays in expanding knowledge and solving problems in our world.

The research process is a structured approach for investigating questions or solving problems through systematic inquiry. Here are the key steps involved:

1. Identify and Define the Research Problem

- **Select a Topic**: Choose a subject area that interests you and is feasible to explore.
- **Refine the Question**: Narrow down a broad topic to a specific research question or hypothesis. It should be clear, focused, and researchable.

2. Conduct a Literature Review

- **Gather Background Information**: Review existing studies, articles, books, and other sources to understand what has already been researched.
- **Identify Gaps**: Look for areas where research is lacking or questions that remain unanswered, which can help refine your research focus.

- **Establish Theoretical Framework**: Identify key theories, models, or frameworks that can guide your research approach.

3. Formulate Hypothesis or Research Questions

- **Develop Hypotheses** (if applicable): If your research is experimental, you may create testable hypotheses. For exploratory research, a central research question may guide your investigation.
- **Set Objectives**: Define the goals or objectives that will help focus the research process.

4. Choose Research Methodology

- **Select a Research Design**: Decide on a quantitative, qualitative, or mixed-methods approach, depending on the research question.
- **Choose Data Collection Methods**: Determine how you will gather data (e.g., surveys, interviews, experiments, observations).
- **Plan the Sampling Method**: Choose the sample size and method of selection (e.g., random sampling, convenience sampling).

5. Collect Data

- **Prepare Instruments**: Develop tools or instruments, such as surveys or interview guides, if needed.
- **Conduct Data Collection**: Gather the data by implementing your chosen methods, ensuring accuracy and consistency.

6. Analyze the Data

- **Organize the Data**: Clean, organize, and prepare data for analysis.
- **Analyze the Data**: Use appropriate statistical or thematic analysis techniques based on your research design.
- **Interpret Results**: Compare findings to your hypotheses or research questions and explore patterns, trends, or relationships.

7. Draw Conclusions and Implications

- **Summarize Findings**: Discuss the main findings and their significance in relation to your research questions.
- **Implications**: Identify the implications of your findings for theory, practice, or future research.
- **Limitations**: Address any limitations or challenges encountered during the study.

8. Report and Disseminate Findings

- **Prepare a Research Report**: Write a comprehensive report detailing your research process, findings, and conclusions.
- **Present and Publish**: Share results with others by publishing in journals, presenting at conferences, or disseminating to relevant stakeholders.

9. Reflect and Plan Further Research

- Based on your findings, consider further questions or aspects to explore, as research often leads to new inquiries.

Each step in the research process builds on the previous one, ensuring a thorough and rigorous approach to answering the research question.