

# The problem in scientific knowledge

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## What is the method of my research project?

This is the first question advisors usually hear from students, who are always concerned with data collection techniques and whether their project will be qualitative or quantitative. Sometimes, we even label ourselves: "I am a professor who only works with quantitative data". Based on that, students who identify themselves with that line of work seek our advisement. To what extent does a researcher define the method that will be developed in a study? How do we delimit a methodological path?

Based on these considerations, other questions regarding science emerge. It is common to hear criticism regarding scientific advancements. Does science produce positive results for society, or is it only an instrument of power?

These questions span several decades and permeate the most different contexts, yet, remain current and relevant. Contributing to the training of students from a critical-reflexive perspective has the potential to improve their academic achievements, enable them to learn how to read and understand what a researcher is telling, and engage in academic tasks by methodologically organizing their thoughts and seeking to solve problems. In the long term, research will be applied in their field of work and professional practice to continue improving their performance and elevating their performance and understanding.

What we wish to clarify first is that a research method is not simply delimited by theoretical preferences; instead, there is a context surrounding a researcher and all the variables that involve a given topic that needs to be considered. Moreover, researchers need to master a given methodology while the topic chosen needs to be well-delimited and contextualized to only then decide on the project's scientific method.

## Why study the scientific method?

Scientific research is considered the best method humans developed to obtain reliable knowledge. The researchers' questions and the method used to answer such questions emerge from researchers' perspectives regarding how the world functions.

This is what we call paradigm, a global overview, an overall perspective on the world's complexities. In this context, it is vital that researchers have a minimum understanding of the epistemology of knowledge, and be able to reflect upon reality, the approach involving all the processes, and how a study object is related to themselves as researchers, and what values pertain to this object.

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Habermas (2002) considers that it is not a matter of changing or improving the situation of subject-centered reasoning. The paradigm that represents the knowledge of objects should be replaced by the paradigm of understanding among individuals able to talk and act. In the knowledge paradigm, a conscious individual refers to him/herself in the same way as to entities of the world. In the understanding paradigm, when the ego talks and the alter takes a stand, they participate in an interpersonal relationship. Hence, the ego is in a relationship that, from the alter's perspective, enables it to refer to itself as the participant in an interaction.

Therefore, it is essential to realize that scientific knowledge is produced by individuals who think, feel, and do and there is a constant interaction between thinking, feeling, and doing. Hence, researchers need to rethink the strict sequence of steps taught in the scientific method, which starts with observation and culminates into a conclusion, a discovery (Moreira, 1993).

To understand how research is developed, how a given result is highly accurate or little significant, or yet, how a thesis is refuted, it is essential to study the method, the methodology. It is vital to know and practice; only then is it possible to assess the results of studies critically.

Hence, some concepts need to be clarified. Know that method originates from the Greek *méthodos* (*meta*= following after +*ódos*= path). Following its origin, a method is one way or the way to reach an end or objective, which is distinguished from methodology, which originates from the Greek word *méthodos* (way to achieve an objective) +*logos* (knowledge). Hence, methodology is the study of method. Hence, there are procedures and rules implemented for a given method. Therefore, a scientific method is the science's way to reach an objective, while methodology refers to the rules established for a scientific method (Richardson, 2017, p. 16).

Now that we understand that the methodological path needs to be studied to be delimited, we start reflecting upon the selection of the best technique to collect data and the most appropriate strategy for analysis. It may even sound philosophical, but who or what defines a given method for a project is the research problem. Students need to understand the importance of a well-delimited research problem to describe what one desires to study clearly and what objective one aspires to achieve.

## The contribution of the scientific method for society

We need to be autonomous and have the ability to problematize, contextualize, criticize, and reflect upon theoretical and applied studies to advance scientific knowledge. A research problem delimits the method and establishes socio-environmental relationships with scientific and technological concepts.

Lakatos and Marconi (1982, p. 39-40) refer to the method's distinctive characteristic of supporting understanding, in its broadest meaning, not the results of scientific investigation, but the investigation process itself.

By corroborating this thought, we argue that the same object can be considered from different perspectives, but for it to happen, researchers need to master its content and all the circumstances that may influence it. A more comprehensive way to deal with degrees of differences between quantitative and qualitative methodological approaches lies upon the basic philosophical assumptions researchers assume and research strategies used in the entire study. Thus, once more, the need to acquire epistemological knowledge regarding science stands.

Therefore, there are some technical procedures to support the delimitation of a research problem. First, the problem must be a problem that draws attention and requires an answer. The researcher has to recompile information related to this problem and study potential relationships between pieces of information to contribute and clarify the problem and then propose potential explanations (hypotheses).

Based on these procedures, researchers need to understand that research is a way of thinking, critically analyzing the various aspects of daily professional practice, formulating guiding principles of a given procedure, and developing and testing new theories to contribute to the profession's advancement, benefiting society.

Understanding the application of the scientific method when addressing apparently non-scientific problems is essential to identify and transform reality (Richardson, 2017, p. 17). In this context, researchers need to be aware that their role is to keep this inter-relationship with society, considering potential risks and benefits of scientific discoveries, associated ethical issues, the interests involved, the origin of resources financing research, and potential economic, environmental, and social impacts.

Currently, the most significant challenge posed to professors and researchers is to enable students to acquire this autonomy and the ability to be critical, contextualize and problematize problems. Therefore, some personal and social considerations can be prioritized, and scientific research will produce a significant product in cultural, social, and technological terms to outgrow the academic environment in which it was developed and contribute to citizenship and science education training.

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