




DG ENV/MSFD Second Cycle/2016

The scientific method

Background material - SCIENTIFIC GAME



Authors

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Find more information on the project website www.medcis.eu.

The scientific method

The **scientific method** consists of collection data through observation and experiments in order to formulate hypotheses and theories. The scientific method is the way in which science investigates reality and is the method stated in the definition of knowledge. The modern conception of scientific method is due to Galileo Galilei.



Statue of Galileo Galilei
(Aristodemo Costoli)

The main steps of the scientific method are the following:



analysis of the problem - the researcher begins to gather information about the problem itself in order to understand its nature

formulation of a hypothesis - the researcher formulates a possible solution to the problem



definition of work/sampling - the researcher defines the sampling method that will follow for the research activities

data collection - the researcher collects data and information



processing the collected data - the researcher processes the data collected to produce one or more final results

testing hypothesis - the researcher verifies the correspondence between the results obtained from the research and its initial assumptions



communication of results - the final stage of the research process is the communication of the results.

Deductive method

It is a cognitive process from the general to the particular. In the deductive model the scientist start from the general principles of the enunciation to get more able to explain particular phenomena. The deductive process that leads from the general to the particular is based on reasoning and logic. The deductive method is contrasted with the inductive method, both methods are known from the early Greek philosophers. The greek philosopher Aristotle uses the deductive method to construct the concept of Aristotelian syllogism by which from

two general statements we can come to a particular conclusion by following a logical reasoning.



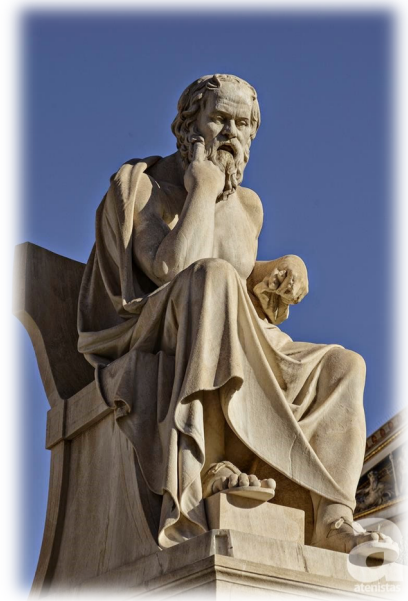
Aristotele: bronze statue (University of Friburgo)

In the deductive method two general statements are required in order to deduce a third statement. Example:

- ✓ *All men are animals*
- ✓ *All animals are mortal*
- ✓ *(so) All men are mortal*

Inductive method

It is a cognitive process from the particular to the general. In the inductive model, the scientist begins with the observation of particular and concrete phenomena to reach the enunciation of general and universal laws to explain other similar phenomena. The inductive method is contrasted with the deductive method and is known since the birth of Greek philosophy.



Socrate, statue of Leonidas Drosis (1885)

In the inductive method, the researcher tries to reach a general statement from the observation of some details of actually. Example:



- ✓ *Charles saw a black panther*
- ✓ *John saw another black panther*
- ✓ *(so) Probably all panthers are black*

In the inductive method the first two statements are based on the observation of the reality surrounding the observer. It is, however, of particular aspects and not of true statements in a general sense. For this reason, the inductive method is the basis of the experimental method; only the collection of data and the repetition of experiments allow to corroborate in a general sense the result obtained with the inductive method.

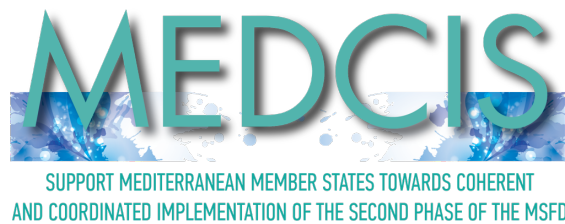
Experimental method

It is mainly based on the observation of physical phenomena using mathematics and reproducible experiment. Through the observation of phenomena and repeated experimentation the researcher can interpret mathematical relationships that underlie and determine the

natural phenomena. The researcher formulates scientific hypotheses and submits to the control of the experimental method. The hypothesis confirmed by repeated experiments are transformed into scientific laws. The same method (experimental) can be used to refute

existing laws. During the eighteenth century, the experimental method is rapidly spreading in the academic

world as a universal method of investigation.



**UNIVERSITÀ
DEL SALENTO**

Contact: medcisingaming@unisalento.it
Davide Calcagnile: davide.calcagnile@unisalento.it
Franca Sangiorgio: franca.sangiorgio@unisalento.it