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Chapter 1.- Nature of Science

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1.1. Concept of Science

Throughout the history of mankind, have been developed and tested many ideas related on the physical, biological, psychological and social development. These ideas have enabled later generations to understand more clear and reliable to the human species and its environment. The ways used to develop such ideas are particular forms of observation, thinking, experimentation and try, which represent a fundamental aspect of the nature of science and reflect how much does it differs from other forms of knowledge.

The union of science, mathematics, and technology forms the scientific endeavor and makes this a success. Although each of these different fields have their own character and history, are interdependent and mutually reinforcing.




In definition, **Science** (From the Latin *Scientia* 'Knowledge') is the body of knowledge obtained through observation and reasoning, systematically structured and those deduced general principles and laws.

Science is the eternal question of nature by human. Although a theory assumes the hierarchy of a "Law", because the concordances do not seem to generate any doubt, is not definitive, but is waiting for the next amendment. An example are the laws of gravitation which remained uncontested for two centuries, until the observed behavior on the planet Mercury cannot be adjusted exactly to them. There was a discrepancy that the theory of relativity of Einstein helped explain and, to that extent, the laws had to be amended, therefore, science is the current verification without the final certainty.

Science as a concept is known as the systematized knowledge, developed through observations, reasoning and evidence methodically organized. Science uses different methods and techniques for the acquisition and organization of knowledge on the structure of a set of objective facts and accessible to a number of observers, in addition to being based on a criterion of truth and a permanent correction. The application of these methods and knowledge leads to the generation of more objective knowledge in the form of concrete predictions, quantitative and verifiable observable facts relating to past, present and future. Often these predictions can be formulated through reasoning and be structured as general rules or laws, which give account of the behavior of a system and predict how it will act in certain circumstances.

In conclusion we can say that the words "science" and "scientific" have become overloaded in terms of ratings because they have been given a arrogant, or magical character (because their language has become a kind of abracadabra to the village). When we say that we live in "the scientific age", we affirm by implication that there has been some discontinuity in the human spirit of inquiry; what we are saying is that there has been an increase in the investigation and there has been an acceleration in the pace of discoveries, which have confirmed or refuted theories or have contributed to the progress of knowledge. If our means of knowledge we provide greater accuracy and safety, we can get more confident and quickly into the unknown.

The epistemologist German Rudolf Carnap was the first to divide the science in the following way (scientific disciplines):

 <p>FORMAL SCIENCE</p>	Set the logical reasoning and work with ideas created by the mind. It creates its own object of study; its method of work is the inductive logic, with all its variants. Some examples of the formal sciences are: mathematics, logic, science, etc.
 <p>Natural Science</p>	They encompass the natural sciences which have as their purpose the study of nature. Follow the scientific method: Astronomy - Biology - Physical - Geology - Chemistry - Physical geography
 <p>SOCIAL SCIENCE</p>	Disciplines that deal with the aspects of the human being - Culture and Society- the method depends on each particular discipline: Anthropology - Political Science - Demographics- Economy - Right- History - Psychology - Sociology - Human Geography - Social Work

Finally, a more concrete definition of Science could be:

"The Science seeks to explain the reality of nature by laws, which allow in addition predictions and practical applications (technology). Scientific knowledge is an objective knowledge that is structured in verifiable systems, obtained methodically and reported in a constructed language with precise rules and explicit where prevents ambiguity and without senses of the expression."

Another definition of science is the following:

"Science is the unified set of knowledge and research, of an objective nature, about the relationships between the facts, that are discovered gradually and that are confirmed by verification methods defined".

1.2. Scientific knowledge and its features

Every science has its specific method but we can find certain general characteristics. The scientific knowledge of principles, which are based on two fundamental activities of the science:

- 1.-The principles are taken from the experience, but they can be hypothesis or postulates
- 2.-On the basis of the principles science uses the demonstration, to draw conclusions that form the scientific knowledge.

Scientific knowledge is a critical knowledge (informed), methodical, verifiable, systematic, orderly, unified, universal, objective, communicable (by means of the

scientific language), rational, provisional and that explains and predicts facts by means of legislation.

Some of the characteristics of scientific knowledge are:

- Scientific knowledge is critical because it seeks to distinguish the true from the false. It is distinguished by justify their knowledge, to give evidence of their truth, therefore it is informed, because it shows that it is true.
- It is based through the methods of research and testing, the researcher follows procedures, develops its task on the basis of a previous plan. Scientific research is not erratic but planned.
- Verification is possible through the adoption of the review of the experience. The verification techniques evolve over time.
- It is systematic because it is an orderly unit, new knowledge is integrated into the system, interacting with those that already existed. It is ordained because it is an aggregate of isolated information, but a system of ideas connected to each other.
- It is a unified knowledge because they are looking for a knowledge of the singular and concrete, but the knowledge of the general and abstract, or of what things are identical and permanent.
- It is universal because it is valid for all people without recognizing borders or determinations of any kind, does not vary with the different cultures.
- It is objective because it is valid for all individuals and not only for one particular. It is of value and not individual or singular value. Get to know the reality as it is, the guarantee of objectivity are their techniques and methods of research and testing.
- It is communicable through the language of science, which is precise and unambiguous, understandable to any subject, trained personnel, who will be able to obtain the necessary elements to check the validity of the theories in their logical aspects and verifiable.
- It is rational because science knows the things through the use of intelligence, of reason.
- Scientific knowledge is provisional because the task of science does not stop, it continues its research in order to better understand the reality. The search for truth is an open task.
- The science explains the reality through laws, these are constant and necessary relations between the facts. Universal propositions are set out under what conditions is determined fact, they include particular facts. Also allow to

anticipate events, predict them. The explanations of the facts are rational, obtained through observation and experimentation.

The scientific knowledge raises the duty to use a method equally critical and authoritative scientific knowledge itself, which we call *Scientific method*.

The Scientific Method

The scientific method is the way ordered to proceed to the knowledge of the truth, in the area of particular scientific discipline.

The method has the goal to determine the rules of the research and the testing of the scientific truths. It includes the study of the ways by which extends the human mind and orders their knowledge.

According to this definition, it can be considered different steps which conform the completed scientific method:

1. Make an Observation

Scientists are naturally curious about the world. While many people may pass by a curious phenomenon without sparing much thought for it, a scientific mind will take note of it as something worth further thought and investigation.

2. State the problema and identify variables

After making an interesting observation, a scientific mind itches to find out more about it. This is in fact a natural phenomenon. If you have ever wondered why or how something occurs, you have been listening to the scientist in you. In the scientific method, a question converts general wonder and interest to a channelled line of thinking and inquiry.

3. Form a Hypothesis

A hypothesis is an informed guess as to the possible answer of the question. The hypothesis may be formed as soon as the question is posed, or it may require a great deal of background research and inquiry. The purpose of the hypothesis is not to arrive at the perfect answer to the question but to provide a direction to further scientific investigation.

4. Design an Experiment and collect data

Once a hypothesis has been formed, it must be tested. This is done by conducting a carefully designed and controlled experiment. The experiment is one of the most important steps in the scientific method, as it is used to prove a hypothesis right or wrong, and to formulate scientific theories. In order to be accepted as scientific proof for a theory, an experiment must meet certain conditions – it must be controlled, i.e. it must test a single variable by keeping all other variables under control. The experiment must also be reproducible so that it can be tested for errors.

5. Analyse the Data and Draw a Conclusion

As the experiment is conducted, it is important to note down the results. In any experiment, it is necessary to conduct several trials to ensure that the results are constant. The experimenter then analyses all the data and uses it to draw a conclusion regarding the strength of the hypothesis. If the data proves the hypothesis correct, the original question is answered. On the other hand, if the data disproves the hypothesis, the scientific inquiry continues by doing research to form a new hypothesis and then conducting an experiment to test it. This process goes on until a hypothesis can be proven correct by a scientific experiment

1.3. Other types of knowledge

The term “knowledge” is the ability to act, process and interpret information to generate more knowledge or give a solution to a given problem. The knowledge can be interpreted and understood by human beings and even by machines through intelligent agents, this is achieved through knowledge bases, or sets of training and logical inference.

This term is defined by scientists and researchers in two ways: as a mental representation of reality and how the information can be transmitted from one entity to another by non-genetic. According to these definitions and the methods used to construct or to generate knowledge, knowledge is divided into:

- Intuitive knowledge
- Empirical knowledge
- Religious knowledge
- Philosophical Knowledge

Intuitive knowledge:

Intuition is a arbitrary verdict from the cognitive experience. Intuitive knowledge is defined as the immediate apprehension of internal or external experiences in their experimentation or perception. To this apprehension, the metaphysicians call it spiritual, because it is sensitive, but we know that there is, so it also becomes not deniable. How the human being, learn by three elements of her psychic structure -the reason, the knowledge, the will - the judgments that are issued based on this type of knowledge they become independent and personal, even when there is a consciousness cognoscente general in the human being. In other words, there is knowledge that we acquired by nature, but that everyone has in one degree or another.

The intuition is based on the informal sector and rapid processing of cognitive experiences and works as a principle to the solution to a problem or situation in question. The Science is full of intuitions, some that lead to success, other that lead to

the error but that produce a new experience that subsequently will be codified in a new intuition now more successful.

Empirical knowledge:

The knowledge is as its name suggests, theory, that is, a philosophical explanation and interpretation of human knowledge. The empirical knowledge is the knowledge based on experience and, ultimately, in the perception, because it tells us that it is what exists and what are its characteristics, but does not tell us that something must necessarily be as well, and not in any other way; nor gives us true universality.

The empirical knowledge has character:

- **Particular:** When you cannot guarantee that the known is always and in all cases, as in the case of knowledge: "In the autumn, the trees lose their leaves."

- **Quota:** The object to which we attach a Pen-sable property or feature is that you don't have: even if until now, the trees have always lost their leaves in autumn, it is conceivable that at a future time do not lose.

"All knowledge starts with the experience, but by no means all the proceeds of the experience"

This tells us that the empirical knowledge comes from the observation of our environment, but not everything we learn is by empiricism, because after the observation of the phenomenon in question the human being tries to play it and control it, and it follows the scientific knowledge.

Religious or traditional knowledge:

Religion is an element of human activity that usually consist of beliefs and practices on issues of existential type, moral and supernatural. There is talk of "religions" to refer to specific forms of manifestation of the religious phenomenon, shared by the different human groups. There are religions that are organized more or less rigid forms, while others lack of formal structure and are integrated in the cultural traditions of the society or ethnic group in which it is practiced. The term refers to both the personal beliefs and practices how to collective rites and teachings.

Philosophical Knowledge:

It is the knowledge that comes from the systematic and methodical reflection about ultimate truths of human existence and of everything that surrounds us. Originally the philosophical knowledge covered or understood the knowledge about the nature of the world and of human beings, but to the extent that the philosophy and philosophers were discovering laws of nature, they were separating from the philosophy to be bodies or independent knowledge systems as autonomous disciplines. These went on to become a

separate scientific disciplines of philosophical thought in such a way that although the philosophy represents the search of true knowledge, it does great fundamental truths of life and the universe through methodical and systematic reflection, while the scientific knowledge refers to more specific aspects. The philosophical knowledge is permanently open to revision, at the same time it is often offer more than one vision of the same phenomenon under study, and contradictory.