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DEFINITION OF SCIENTIFIC METHOD

The scientific method or process is fundamental to the scientific investigation and acquisition of new knowledge based upon physical evidence. Science manages new assertions about our world with theories, hypotheses and observations. Predictions from these theories are tested by experiment. If a prediction turns out correct, the theory survives, but if a prediction fails the theory fails. The scientific method is essentially an extremely cautious means of building a supportable, evidenced understanding of our world. A scientific method consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses. Scientific method refers to a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge. To be termed scientific, a method of inquiry must be based on gathering observable, empirical and measurable evidence subject to specific principles of reasoning. The scientific method is the basic method, guide, and system by which we originate, refine, extend, and apply knowledge in all fields.

The word science has its origins in the Latin verb *scire*, meaning “to know.” Although, one can “know” through tenacity, authority, faith, intuition, or science, the method of science or the scientific method is distinct in its notion of inter – subjective certification. In other words, it should be possible for other

investigators to ascertain the truth content of scientific explanations. “Scientific knowledge thus rests on the bedrock of empirical testability”. Empirical replication depends on a comparison of “objective” observations of different researchers studying the phenomenon.

The Scientific Method has Four Steps:

• Observation and description of a phenomenon or group of phenomena.
• Formulation of a hypothesis to explain the phenomena.
• Use of the hypothesis to predict the existence of other phenomena, or to predict quantitatively the results of new observations.
• Performance of experimental tests of the predictions by several independent experimenters and properly performed experiments.

THE EVOLUTION OF SCIENTIFIC METHODS

Modern western science had its beginnings with the Greeks, who conceived the revolutionary idea that the universe was a kind of machine governed by inflexible laws. This idea became the mechanistic model of science. The Greek philosophers devoted themselves to the task of discovering, through intellectual reasoning alone, the laws of the universe. Modern scientific thought, thus, evolved from the Greek philosophers who were influenced by the Egyptians, Babylonians,and Assyrians. Their greatest successes were in the field of geometry. The Greek successes are attributable to two techniques: abstraction and generalization. So successful were these techniques in developing mathematical theory that the concepts were extended to other disciplines, but with much less success. However, the process of looking for absolute truth through reasoning alone was so ingrained in the Greek thinking patterns that they ignored the experiential evidence which was contrary to their elegant theorems and proofs.

The Renaissance thinkers, however, brought a fresh outlook. The most famous turning point came in 1543 when the Polish astronomer Copernicus published a book which proposed the sun, not the earth, as the centre of the universe.

Although this hypothesis had been put forth in 200 B.C.E, it was in 1543 diametrically opposed to the assumptions of the Greeks and the teachings of the Church that caused a great uproar within the intellectual world. It was left to Galileo to have the audacity to test the Greek theories. His most famous experiment probably never happened, but it makes a good story. Galileo

supposedly dropped two cannon balls of different weights from the leaning tower of Pisa to prove Aristotle's theory that the heavier body would hit the ground first. The resounding thump of the two spheres hitting the ground simultaneously killed Aristotelian physics and elevated inductive reasoning as a scientific tool. Inductive reasoning begins with observations and derives generalizations (axioms) from the observations; whereas deductive reasoning, the method of the Greeks, begins with generalizations and proceeds to predict observations. But it was the recognition during the Renaissance that no amount of deductive reasoning can render a generalization completely and absolutely valid that turned the Greek philosophy upside down.
Francis Bacon offered four steps for scientific work: observe, measure, explain, and verify. And then there was René Descartes who also gave four rules for his method to find the truth in 1961. The rules are as follows:

• Never to accept anything for true which I do not clearly know to be such
.• Divide each of the difficulties under examination into as many parts as possible.
• Begin with the simplest and easiest and then work step by step to the more complex.
• Make enumerations so complete and reviews so general that I might be assured that nothing is omitted.

The essentially contemporaneous writings of Galileo, Bacon and Descartes revolutionized scientific procedures and gave rise to what has been called the scientific method. The collective ideas which Galileo, Bacon, and Descartes brought to scientific endeavour have changed somewhat since the 17th century. By the 19th century, the method developed into six steps, and in the 20th century the method developed into seven, namely:

• Pose a question about nature, not necessarily as the result of an observation.
• Collect the pertinent, observable evidence.
• Formulate an explanatory hypothesis, defining relevant assumptions.
• Deduce its implications.

• Test all of the implications experimentally.

• Accept, reject, or modify the hypothesis based upon the experimental results.

• Define its range of applicability.

The scientific method's essential elements are iterations, recursions interleavings, and orderings of the following four steps:
• Characterization
• Hypothesis (a theoretical, hypothetical explanation)
• Prediction (logical deduction from the hypothesis)
• Experiment (test of all of the above)

Iteration is the repetition of a process, it is a repetition in a specific form of repetition with a mutable state and recursion is a particular way of specifying or constructing a class of objects with the help of a reference to other objects of the class: a recursive definition defines objects in terms of the already defined objects of the class. Interleaving is a way to arrange data in a non-contiguous way to increase performance. Orderings formalizes the intuitive concept of an ordering, sequencing, or arrangement of the elements of a set.

Characterization
The scientific method depends upon a careful characterization of the subject of the investigation. Here the subject may also be called the problem or the unknown. Observation demands careful measurement and the use of operational definitions of relevant concepts. Formally, these terms have exact meanings which do not necessarily correspond with their natural language usage. For example, mass and weight are quite distinct concepts. New theories may also arise upon realizing that certain terms had not previously been clearly defined. For example, Albert Einstein's first paper on relativity begins by defining simultaneity and the means for determining length. These ideas were skipped over by Newton with, "I do not define time, space, place and motion, as being well known to all." Einstein's paper then demonstrates that these widely accepted ideas were invalid.

SIGNIFICANCE OF SCIENTIFIC METHODS
The scopes of scientific methods are massive and very useful in our life. Scientific method is not a recipe. It requires intelligence, imagination, and creativity. It is also an on-going cycle, constantly developing more useful, accurate and comprehensive models and methods. Science is not merely a collection of facts, concepts, and useful ideas about nature, or even the systematic investigation of nature, although both are common definitions of science. Science is a method

of investigating nature, a way of knowing about nature that discovers reliable knowledge about it. In other words, science is a method of discovering reliable knowledge about nature. There are other methods of discovering and learning knowledge about nature. These other knowledge methods or systems will be discussed below in contradistinction to science, but science is the only method that results in the acquisition of reliable knowledge.

Reliable knowledge is knowledge that has a high probability of being true because its veracity has been justified by a reliable method. Reliable knowledge is sometimes called justified true belief, to distinguish reliable knowledge from belief that is false and unjustified or even true but unjustified. The important distinction that should be made is whether one's knowledge or beliefs are true and, if true, are justifiably true. Every person has knowledge or beliefs, but not all of each person's knowledge is reliably true and justified. In fact, most individuals believe in things that are untrue or unjustified or both: most people possess a lot of unreliable knowledge and, what's worse, they act on that knowledge. Other ways of knowing, and there are many in addition to science, are not reliable because their discovered knowledge is not justified. Science is a method that allows a person to possess, with the highest degree of certainty possible, reliable knowledge, justified true belief about nature. The method used to justify scientific knowledge, and thus make it reliable, is called the scientific method. The scientific method has proven to be the most reliable and successful method of thinking in human history, and it is quite possible to use scientific thinking in other human endeavours

It is of great national importance that the scientific method, which is not just for scientists but is really a general problem solving method for everyone. Centuries of study, debate, and experimentation has established that the best of all methods of obtaining and originating reliable knowledge in all fields is the scientific method. The scientific method is the guide to the mental activities and systems needed to solve the complex competitiveness problems. It is, rather, an attitude, a philosophy, an ethic to guide the process humans use to make sense out of the deluge of sensory experience which is the foundation of our progression to Paradise. As it has evolved, the method is so pervasive that it can be used in any discipline, forcing the theoretician and experimentalist to complement one another. It bridges the gap between ideas and facts, between speculation and experience, between chaos and order. It allows the sorting of

the relevant and useful from the impertinent and delusive. It allows the exploitation of those rare moments of intuitive inspiration and insight which have proven so indispensable to scientific progress. However, the method cannot replace intuition, conjure good luck, dissuade misuse, or speed the slow process of intellectual growth and seasoning.

Conclusion :

Hence, Scientific method which is used in systematic study of science as well as to determine the facts making prediction theory and scientific law. It includes observation, hypothesis, prediction, experiment, theory and scientific law.