

Scientific Methods of Research

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- The scientific method is a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge.
- The scientific method is an ongoing process, which usually begins with observations about the natural world.
- The Oxford English Dictionary defines the scientific method as "a method or procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses.

Elements of Scientific Method

- There are different ways of outlining the basic method used for scientific inquiry.
- The scientific community and philosophers of science generally agree on the following classification of method components.
- Characterizations
- Hypotheses
- Predictions
- Experiments

Characterizations

The scientific method depends upon increasingly sophisticated characterizations of the subjects of investigation.

Characterization, when used in materials science, refers to the broad and general process by which a material's structure and properties are probed and measured. It is a fundamental process in the field of materials science, without which no scientific understanding of engineering materials could be ascertained.

Hypothesis

A hypothesis is a suggested explanation of a phenomenon, or alternately a reasoned proposal suggesting a possible correlation between or among a set of phenomena. Normally hypotheses have the form of a mathematical model.

Predictions

Any useful hypothesis will enable predictions, by reasoning including deductive reasoning.

It might predict the outcome of an experiment in a laboratory setting or the observation of a phenomenon in nature.

The prediction can also be statistical and deal only with probabilities.

Experiments

Once predictions are made, they can be sought by experiments.

If the test results contradict the predictions, the hypotheses which entailed them are called into question and become less tenable.

Sometimes the experiments are conducted incorrectly or are not very well

There are two types of models in Scientific Methods of Research.

- Classical model
- Pragmatic model

- The classical model of scientific inquiry derives from Aristotle, who distinguished the forms of approximate and exact reasoning, set out the threefold scheme of abductive, deductive, and inductive inference, and also treated the compound forms such as reasoning by analogy

Pragmatic model

- A pragmatic theory of truth is a theory of truth within the philosophies of pragmatism and pragmatism.
- The common features of these theories are a reliance on the pragmatic maxim as a means of clarifying the meanings of difficult concepts such as truth; and an emphasis on the fact that belief, certainty, knowledge, or truth is the result of an inquiry.

Steps of Scientific Method

The steps of the scientific method were developed over millennial, since the time of the ancient Greek and Persian philosophers.

Whilst there are always minor variations between different scientific disciplines, they all follow the same basic path.

There are six steps as follows:

Step 1: Narrowing Down

- The research stage, through a process of elimination, will narrow and focus the research area.
- This will take into account budgetary restrictions, time, available technology and practicality, leading to the proposal of a few realistic hypotheses.
- Eventually, the researcher will arrive at one fundamental hypothesis around which the experiment can be designed.

Step 2: Designing the Experiment

- This stage of the scientific method involves designing the steps that will test and evaluate the hypothesis, manipulating one or more variables to generate analyzable data.
- The experiment should be designed with later statistical tests in mind, by making sure that the experiment has controls and a large enough sample group to provide statistically valid results.

Step 3: Observation

- This is the midpoint of the steps of the scientific method and involves observing and recording the results of the research, gathering the findings into raw data.
- The observation stage involves looking at what effect the manipulated variables have upon the subject, and recording the results.

Step 4: Analysis

- The scope of the research begins to broaden again, as statistical analyses are performed on the data, and it is organized into an understandable form.
- The answers given by this step allow the further widening of the research, revealing some trends and answers to the initial questions.

Step 5: Conclusions and Publishing

- This stage is where, technically, the hypothesis is stated as proved or disproved.
- This stage is where interesting results can be earmarked for further research and adaptation of the initial hypothesis.
- The results are usually published and shared with the scientific community, allowing verification of the findings and allowing others to continue research into other areas.

Step 6: Cycles

- This is not the final stage of the steps of the scientific method, as it generates data and ideas to recycle into the first stage.
- The initial and wider research area can again be addressed, with this research one of the many individual pieces answering the whole question.
- Building up understanding of a large area of research, by gradually building up a picture, is the true path of scientific advancement.

Conclusion

So finally the brief overview of scientific method is given in this presentation, also it's elements and steps are discussed.

The End