

Semester II

Unit II

Paper VII

Topic - Types of observation in
Biological Science

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Types of Observation in the Scientific Method

The scientific method consists of a series of steps used by scientists to conduct experiments. The word "observation" has two meanings in the scientific method. First, there is the scientist's observation of the world as it leads to hypothetical theory. This is the first step of the scientific method and can be presented in two ways, either as a natural observation or a staged one. Second, in the collection of data in an experiment using the scientific method, there are two types of observations, qualitative and quantitative. Here are some types of observation used in biological science.

Observed Naturally

When a scientist sets out to prove something using the scientific method, he must first observe something in the natural world. For instance, Sir Isaac Newton theorized that there was a force called gravity after he watched an apple fall from a tree. This would be a natural observation. Newton saw something happen in nature without any intervention on his part or the part of anyone else. This type of observation means the scientist will watch and wait for the event to happen during an experiment.

Staged Observation

If Isaac Newton had come up with his theory of gravity after dropping an apple from a balcony, his observation would be characterized as staged. Many experiments begin with a scientist thinking "what if" -- e.g., "What if I drop this apple from a balcony? What will happen?" In this form of observation the scientist creates a hypothetical theory from thinking about something in nature, intervening in nature and observing the event. This type of observation generally dictates that the experimentation that comes from the observation will have to be recreated.

Quantitative Observation

In the scientific method, after a scientist comes up with a theory based on an observation of something in nature, she starts an experiment. Once the experiment is underway, it must be observed. The scientist records the observations of the experiment and collects data. One form of data collection during the method is quantitative. This form of observation during an experiment employs mathematical models and relies on the scientist to collect information based on numbers, such as how many apples fell from a tree or balcony. Quantitative observation is common in physics, biology and the natural sciences.

An example of a quantitative observation is "John spends \$300 dollars a month in petty cash." Another is: "This is the fourth time in two weeks John has worked

overtime." Both of these observations consist of hard numerical data, and are quantitative

Qualitative Observation

When a scientist performs an experiment that requires observations concerning the quality of what has happened in an experiment, it is considered a qualitative observation or data. Examples include the shapes of the apples that fell from a balcony or tree or what happened to them when they fell. Qualitative observations can be easily dismissed in experiments that require hard mathematical data, but they are made nonetheless. Qualitative observations can be very important in experiments that require interpretation.

The word quantitative means "of, relating to, or expressible in terms of quantity," according to Merriam-Webster's Dictionary. "Quantitative observation" is defined by the University of South Alabama as "standardized observation." Simply put, quantitative observations are those in which the focus is the numbers

Quantitative observations should not be confused with qualitative observations, or those pertaining to quality. The observation "John works hard, but seems distracted," is not quantitative; it refers to the quality of John's performance, so it is qualitative.

Laboratory Observation Methods

Laboratory observations happen when a person gathers and records information about an experiment within a laboratory setting. Examples of lab observations include noting the formation of crystals and recording survey results. There are several ways of conducting observations in a lab, and the method that you choose often depends on the type of experiment you are doing.

Natural and Contrived

Natural observations are observations that you make of subjects while they are in their real-life or natural environment. You have little control over your subjects when performing this type of observation, so gathering the right type of data may be more time consuming, but the information gathered accurately reflects your subjects' natural behaviour. Using the natural observation method can be difficult in a laboratory setting, as subjects typically are not in their natural setting in a laboratory environment. On the other hand, contrived observations are conducted in settings created by the observer, as within a laboratory. Contrived observations offer you more control over the data gathering process, but the data may not reflect real-life phenomena.

Disguised and Non-Disguised

Within a laboratory setting, scientists can conduct both disguised and non-disguised observations. Disguised observations are made when the subject does not know he or she is being observed. Subjects tend to act more naturally during

disguised observations, and the information collected is more apt to reflect their true reactions. There are ethical concerns with this method of data gathering, however, because the subject might not want private information recorded by the researcher. Non-disguised observations, on the other hand, occur when the subject knows that observations are taking place. The ethical concerns are alleviated but you may not get accurate or true information when using this method.

Direct and Indirect

Laboratory observation can use direct or indirect observation methods. Making a direct observation is looking at or studying an actual behaviour or occurrence instead of the result of that behaviour or occurrence. An indirect observation happens when the researcher studies the results or consequences of an occurrence instead of the actual occurrence itself. An example of a direct observation is watching birds feeding and taking note of what types of food they eat. An example of an indirect observation is analysing bird droppings to see what type of foods they ate.

Human and Mechanical

Within a laboratory setting, scientists can make human or mechanical observations. Human observations are made when the observer or researcher collects data using his eyes, ears, nose and other senses. Mechanical observations are those made using mechanical devices such as video cameras, microscopes and weather balloons. After data has been collected by the devices, it is interpreted by the researcher. Mechanical devices offer a way of collecting more precise data than simply through human observations.

Empirical Observation

The scientific method is empirical. That is, it relies on direct observation of the world, and disdains hypotheses that run counter to observable fact. This contrasts with methods that rely on pure reason (including that proposed by Plato) and with methods that rely on emotional or other subjective factors

Systematic Observation

Strictly speaking, the scientific method is systematic; that is, it relies on carefully planned studies rather than on random or haphazard observation. Nevertheless, science can begin from some random observation. Isaac Asimov said that the most exciting phrase to hear in science is not "Eureka!" but "That's funny." After the scientist notices something funny, he or she proceeds to investigate it systematically.