

INTRODUCTION TO THE COURSE: THE GENERAL CONCEPTS

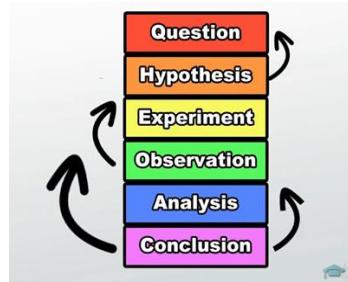
What is Science?

Science is the process of observing and questioning the world around us. Thus, it can be simply defined as “the systematic study of things around us.” We also sometimes call the things we learn through experimentation science. In fact, the term “science” itself comes from a Latin word “scientia” that means “knowledge.” And the names of many branches of science end with the suffix “ology” which means “study of” in Greek. To name a few, we have biology as the study of living things, zoology as the study of animals, and parasitology as the study of parasites. From these we can further define science as “an organized body of knowledge about nature.” In a broader definition, science is “the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment.”

Scientists aim to gain new knowledge through a discipline comprised of a set of steps called the scientific method. The scientific method is a set of procedures that scientists follow in order to gain knowledge about the world. However, the steps involved in the scientific method vary widely among the different scientific disciplines. Chemists follow the method a bit differently than psychologists. Geologists and botanists have their own unique methods.

So is there really one scientific method that encompasses all of science?

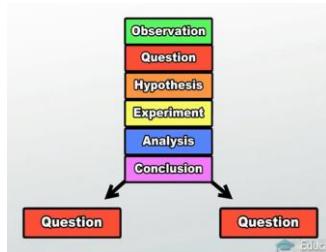
To find it out, we'll need to learn more about the scientific process. There are six key steps that tend to characterize the scientific method – the question, hypothesis, experiment, observation, analysis, and conclusion. The first step is the question. This is the part where the scientist proposes the problem that he wants to solve. A well-conceived question usually leads to a hypothesis. Hypothesis is a potential answer to the question at hand. Sometimes, hypotheses look more like predictions; the scientist predicts what the outcome will be. When he tests his hypothesis, the scientist conducts the so-called experiment. Experiments are ordered investigations that are intended to prove or disprove the hypothesis. Important data comes from performing an experiment. The scientist has to make observations of the results that he gets from the experiment. An observation is a statement of knowledge gained through the senses or through the use of scientific equipment. Observations are crucial for collecting data. Once the results are in, the scientist must begin his analysis. Data analysis involves comparing the results of the experiment to the prediction posed by the hypothesis. Based on the observations he made, the scientist has to determine whether his hypothesis was correct. Then he sums up his findings with a conclusion. The conclusion of a scientific process is a statement of whether the original hypothesis was supported or refuted by the observations gathered.



The scientific method usually employs all six of the steps mentioned but the steps don't always occur in the same order. Real scientists may go back and repeat steps many times before they come to any conclusion. It's actually better to use the word elements to describe the steps since the first step question does not always come first sometimes.



For example, it's an observation that came first and spawned the initial question.



Likewise, observations that are made during an experiment can inspire more questions that scientists have to answer. Science never ends.

It can be concluded that every day scientists make new discoveries and answer new questions. But there are always new mysteries to uncover and problems to solve.

What is Technology?

Technology is defined as the application of scientific knowledge for practical purposes. It may also be referred to as the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, and methods of organization in order to solve a problem, improve a pre-existing solution to a problem, achieve a goal, handle, and apply input/output relation or perform a specific function. It can also refer to the collection of such tools including machinery, modifications, arrangements, and procedures. Technologies significantly affect human as well as other animal species' ability to control and adapt to their natural environments. And the term can either be applied generally or to specific areas. Examples include construction technology, medical technology and information technology.

The human species' use of technology began with a conversion of natural resources into simple tools. The pre-historical discovery of the ability to control fire increased the available sources of food. And the invention of the wheel helped humans in traveling and in controlling their environment.

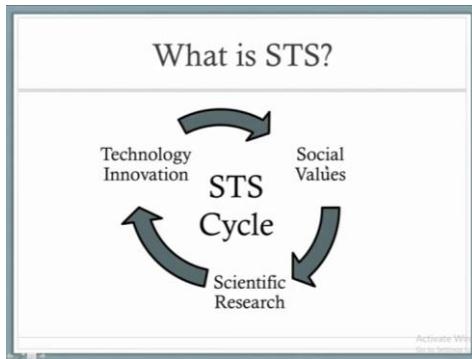
Recent technological developments including the printing press, the telephone and the internet have lessened physical barriers to communication and allowed humans to interact freely on a global scale. However, not all technology has been used for peaceful purposes. The development of weapons of ever-increasing destructive power has progressed throughout history from clubs to nuclear weapons. Technology has affected society and its surroundings in a number of ways. In many societies, technology has helped develop more advanced economies including today's global economy and has allowed the rise of the leisure class. Many technological processes produce unwanted by-products known as pollution and deplete natural resources to the detriment of the earth and its environment. Various implementations of technology influence the values of a society. And new technology often raises new ethical questions. Examples include the rise of the notion of efficiency in terms of human productivity – a term originally applied only to machines, and the challenge of traditional norms.

Science, Technology and Society (STS) Defined

There are three components that comprise Science, Technology & Society. Science is the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experimentation. Technology is the application of scientific knowledge for practical purposes. And lastly, society – a community of people with a common goal. So now when you put all of these together, you get Science, Technology and Society (STS).

But what is STS?

STS is the study of how social, political, and cultural values affect scientific research and technological innovation and then how these in turn affect society, politics and culture. So an easier way of actually stating this is to make a diagram where it just basically shows the STS cycle.



You have social values. And the social values our society feels they need subsequently promote what science researches that leads to what science learns about. And what science learns about, they end up eventually to engineers who make it into a technology that people can use. And in time, that changes what society values. In the long run, this will make a never-ending cycle.

The Role of S&T in the Developing World in the 21st Century

Developments in science and technology are fundamentally altering the way people live, connect, communicate, and transact, with profound effects on economic development. Science and technology are key drivers to development because scientific and technological revolutions underpin economic advances, improvements in health systems, education, and infrastructure. The technological revolutions of the 21st century are emerging from entirely new sectors based on micro-processors, telecommunications, biotechnology and nanotechnology. Products are transforming business practices across the economy, as well as the lives of all who have access to their effects. The most remarkable breakthroughs will come from the interaction of insights and applications arising when these technologies converge.

Through breakthroughs in health services and education, these technologies have the power to improve the lives of poor people in developing countries. Eradicating malaria and cures for other diseases which are endemic in developing countries are now possible, allowing people with debilitating conditions to live healthy and productive lives.

The extent to which developing economies emerge as economic powerhouses depends on their ability to grasp and apply insights from science and technology and use them creatively. Innovation is the primary driver of technological growth and drives higher living standards. To promote such technological advances, developing countries should invest in quality education for youth, continuous skills training for workers and managers, and should ensure that knowledge is shared as widely as possible across society.

The state of science and technology determines the socio-economic progress of the country. It is a well-known fact that national progress is highly correlated to the capacity of a country to produce local industrial goods for domestic needs and that industrialization is very much dependent on the application of science and technology.

However, despite the well-documented advantages that frontier technologies offer in solving a vast range of problems, the world, every now and then, is confronted with new predicaments that only science and technology may resolve. Natural calamities and pandemic crisis pose monumental challenges just as what coronavirus pandemic has wreaked havoc worldwide. The contribution

of science, technology, and innovation at this time of crisis linked to the coronavirus disease is key in facing current health challenges, but also for supporting production efforts aimed at economic recovery after the pandemic. As Shamika N. Sirimanne, head of the UN's Commission on Science and Technology for Development (CSTD) Secretariat said, "Science, technology and innovation [has] provide[d] us a shining light to help us navigate and recover from the COVID-19 pandemic" and for other global crisis that may arise in the future.