KIU Journal of Social Sciences Copyright©2020
Kampala International University ISSN: *2413-9580*; 6(2): 409–417

A Critical History of the Defining Features of Modern Science

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Abstract. Modern Science has a long history of what differentiates it from other disciplines. Its separation from philosophy in the 16th century marked its steady ascent into becoming the king of all knowledge-seeking disciplines. It is almost a given that science is a collection of facts; a body of knowledge that describes and explains the working of nature. The facts of science are fascinating and interesting, but they are not the very essence of science, rather, the excitement of science lies in its inquisitive and curious nature, its intriguing observations, its breath-taking experiments and mathematical proofs that defines its character and purpose. This paper attempts to dig out the defining features that distinguish modern science from other disciplines from its historical antecedents. It carries out a historical exegesis of the rise of modern science drawing out its defining characteristics, from the early Greek philosophers through the medieval era to modern times. It shows that the defining features of modern science are common place procedures carried out by people in their daily activities but, which, taken together as a research procedure, amount to one of the most powerful tools man has devised to know, to conquer, and to control nature.

1. Introduction

The topic of this paper presupposes the periodization of the history of science. The use of the term ‘modern’ specifically points to the features of science in the present or recent times and indirectly refers to the past of science. This is simply the case as there can be no conception of modern science without a reference to science in the past. The reference to the past of science is inevitable since it provides the ground for the proper characterization of what is referred to as modern science. It is therefore not the case that we can proceed in our attempt to outline the features of modern science without having a clear picture of what constitutes science prior to the emergence of modern science and how it has contributed to the development of the features of modern science. In other words, for us to be able to discern the defining features of modern science, we must first and foremost account for its historical preconditions. This exercise will place us at a vantage point to be able to spell out the defining features of modern science.

From the issue adumbrated above, it is apparent that the objective of this paper is to expose the defining features of modern science through a historical and expository approach. Hence, the paper accounts for the historical background to the development of modern science. It also examines the emergence of modern science with its root in the Copernican revolution. In addition, (based on the two preceding steps) the paper extrapolates the defining features of modern science.

1.1 The Historical Background to the Development of Modern Science

The history of the development of science reveals that every scientific breakthrough is usually preceded by a period of uncertainty as regards the proper explanation of the world or a particular challenge to humanity which requires an urgent and probable explanation. Thus, science is seen as a massive problem-solving and information-providing enterprise (Thompson 1). It is in this sense that we can appreciate the role of science in human civilization as a means of understanding and skillful manipulation of nature. And since every human age in history has certain problems and challenges, it follows that there has always been a scientific tradition in every age of human history. This is so because man has the natural inclination to sort for an understanding and explanation of the world around him. This view is corroborated by Uduigwomen when he writes that:

Man, it has always been claimed, has been a scientist since his appearance on this planet. This idea is supported by the fact that man's attempt at building, construction, agriculture and health care through the use of herbs has scientific bearings. (18).

The early human civilization as pioneered by science is traceable to the Babylonians and Egyptians. They are said to possess a considerable body of knowledge to the extent of being able to invent some instruments with which they understood explained and solved certain challenges posed by their environment. This achievement is in line with our earlier conception of science as a problem-solving and information-providing enterprise. Titus, Smith and Nolan articulate the scientific achievements of the Babylonians and Egyptians in early civilization as follows:

More than two thousand years before Christian era began, the Babylonians and Egyptians possessed a considerable body of knowledge. They used fixed units of measurements, such as standards of length, weight, and volume, a multiplication table, tables of squares and cubes, and a decimal system based on man's ten fingers. In Egypt, the periodic rise of the waters of the Nile, resulting in lost of boundary marks, led to a system of land-surveying that stimulated the growth of geometry. Instruments such as set squares; levels, beam balances, and plumb lines, as well as a considerable amount of mathematical knowledge, were needed to build the pyramids. Weaving and spinning were practiced and wheeled chariots were in use. (218).

Following the above scientific activities of the Babylonians and Egyptians, is the genius of the Greeks. With the Greeks, human consciousness and interest in man and nature expanded rapidly. This expansion was so massive that the development of science in the western world is often traced to ancient Greek (Uduigwomen 18). This became a necessary historical practice as the postulations of the pre-Socratic philosophers indicate a paradigm shift from a tradition of mythological explanation of the universe to a natural and rational one. Consequently, the scientific as well as philosophical spirit was born. In fact, the contribution of the Greeks is so great that many of the philosophical cum scientific terms used today are traceable to them.

However, it is pertinent to point out at this juncture that there seems to be some sort of links between the early civilization in Egypt and the scientific speculations of the Greeks. For instance, Thales, the first Ionian nature-philosopher from Greece is reported to have visited Egypt and to have become acquainted with the system of land-surveying in use there (Titus et al. 218). Upon his return from Egypt he advanced geometry and set forth his views about the watery nature of the universe. So, according to Uduigwomen, "as widely travelled people, the Ionians have gathered many ideas from Egypt and the oriental world which enabled them to focus attention on nature" (Philosophy & the Rise of…192).

1.2 The Early Greek Thinkers and the Features of Science

Here, attention will be focused on the basic postulations of the ancient Greek philosophers whose thoughts in one way or the other contributed to the features of modern science. Thus, a detailed discussion of their scientific thoughts will not be carried out as our aim is to excavate the features of modern science through a historical survey of the development of science.

The history of the development of science is usually traced to the pre-Socratic philosophers in ancient Greece, particularly the Ionians or Milesians (Thales, Anaximander & Anaximenes) whose philosophical speculations were mainly attempts to naturally explain the origin and structure of the universe. Thus, they were concerned with cosmology; the scientific study of the universe and its origin and development (Idang 31). Prior to the pre-Socratic philosophers, all natural events were attributed to supernatural causes and things were only understood through a mythological explanation of the universe. The Cosmos (universe) was believed to be inhabited by all sorts of gods, goddesses, godlets, demigods, demons, ancestral ghosts, and a host of other spirits. It was concluded then that events happen because they are willed by these supernatural forces. For instance, it was believed among the Greeks that if lighting strikes, then, Zeus has hurled another thunder bolt. When the sun moves through the heavens, all knew that Apollo is driving in it his fiery chariot (Christian 23). Thus, natural occurrences were explained through the activities of the gods who inhabited the natural world. For this reason, Ozumba concludes that "before the ancient period of philosophy, the thoughts and contemplation of the universe were steeped in mythology and superstition" (49). This mythological conception of the universe was given a literary sanction by Homer and Hesoid in their poetry.

Dissatisfied with this mythological explanation of the universe the pre-Socratic philosophers, particularly the Milesians (Thales, Anasimander, Anaximenes) sought a different kind of explanation; a naturalistic approach to the understanding of the universe. This substantial departure became necessary when they (the pre-Socratics) could not see any rational justification for the mythological views. As such, they embarked upon the task of articulating a more rational, plausible and defensible explanation of the natural world. Popkin and Stroll delineates this philosophical cum scientific spirit of the Milesians as follows:

The thinkers who began the philosophical quest were those who found that when they scrutinized these beliefs they were seen to be inadequate…the explanations were always based upon insufficient evidence, and could never adequately account for all the information people had acquired about the world. Philosophers, to the dismay of their contemporaries, challenged the believers in mythology to provide their views, or to find a better theory, one that would satisfy reasonable people. Out of this rejection of traditionally accepted beliefs, and the search for more plausible or more defensible theories, came the attempts of thoughtful people to explain the natural world in some consistent and rational fashion (xvi).

From the above, it is evident that the Ionian philosophers established two basic traditions which have come down to be an integral part of modern scientific practice. First is the critical attitude and zeal for rational explanation of natural events. This is simply manifested in their rejection of old assumptions and paradigm of explanation and the adoption of a more rational and defensible explanation. Second is the explanation of natural event from nature itself. That is, the paradigm-shift from a supernatural approach to a natural approach of the explanation of the universe. Hence, the ancient Greek philosophers appear to have succeeded in recognizing the difference between a purely rational explanation of things as distinct from myth or religion (Idang 41). This is simply the idea of explaining nature from nature and it is a central feature in the practice of modern science. This credit to the pre-Socratic thinkers is been attested to by Owen when he writes that "their philosophies have been regarded as a pursuit of physical science in a quite positivistic mentality…or as a rational transcription of mythological traditions, or as an intellectual seeking of divine" (5).

At this point, one may begin to wonder how the pre-Socratic thinkers achieved this feat? It was simply through the observation of their immediate environment. They were referred to as a group of thinkers who developed theories to explain the nature of things, based on their observation of the natural world; they were, in effect, the first western scientists. (Thompson 12). In support of this position Onyewuenyi quoting Paul Glenn states that these philosophers:

…saw a world around them which evidently remained the same world, and yet was full of change, motion and of variety… the Ionians felt that, at the back of all changes and varieties in the world, there must be some one thing which is the fundamental material out of which all things are made-some "world-stuff" of which different things are the variant and manifestations (167).

It is important to note at this juncture that the postulations of these set of philosophers were purely speculative. That is, unlike modern scientists, there was no means of experimentation to test their postulations.

From the above, it is clear that although the explanations of the pre-Socratic philosophers were devoid of any physical means of arriving at knowledge. However, the idea of observation and theory formulation is a feature of modern science that is traceable to them. But, to put this argument in the proper context, it is imperative to briefly consider some outstanding scientific achievements of some selected individuals among these philosophers with a view to extrapolating the features of modern science therein.

The pioneering figure of early Greek science is Thales. He is reported to have lived between 624 and 547 B.C in Miletus, Greece. Although, Thales is credited with many scientific feats, but two cases are of primal concern here. First, he is said to have accurately predicted the eclipse of 585 B.C. But, how could he have done this without access to scientific apparatus as it is the case today? Perhaps, Idang's description of the inquisitive nature of Thales answers the question. According to Idang:

Thales was so interested in the heavens to the extent that while gazing upward and scanning the stars; he fell into a well. He became so famous for his practical shrewdness and theoretical wisdom by making important discoveries whose true origin were not known then and in some cases are still obscure (45).

The point in the above quotation is that Thales was always engrossed in the act of observing natural phenomenon. And observation today is a key feature of modern science. Secondly, Thales taught that water was the fundamental material out of which all things were made and the last into which they are resolved (Onyewuenyi 168).

From the above, it is evident that the explanations given by the ancient thinkers were devoid of any physical means of knowledge acquisition. That is, unlike modern science, there was no means of experimentation to test their postulations. However, the idea of observation and theory formulation that is the hallmark of modern science is traceable to them. For instance, Thales is claimed to have arrived at his thesis that water is the primordial stuff by a careful and meticulous observation that all substance are all ultimately reducible to this single element (water). Ozumba is of the view that Thales must have arrived at water based on the following reasons or observations:

That water pervades all things everything consists of water, water is the source of plant and animal life, water is capable of mutation giving rise to the three types of substance that is gaseous, solid and liquid, water is unlimited and contains the finite universe, the earth itself is borne of water, the seed of all things have moist nature and water is the origin of the nature of moist things. Nourishment, heat and living things come from water (51).

In fact, modern science has vindicated Thales as "only one oxygen atom separates Thales from modern physics, for we now consider all substances ultimately to be derived from hydrogen" (Thompson 13). Another clear feature of modern science traceable to ancient Greek thinkers is Mathematics. It was the Pythagoreans under the leadership of Pythagoras who first of all called the attention of the world to the importance of mathematics in the search for the ultimate reality. They attempted to explain everything in mathematical terms and believed that all things are numbers, and can be explained numerically (Idang 72). Quoting Aristotle, Omoregbe captures this point thus:

The so-called Pythagoreans, the first to be absorbed in mathematics, not only advanced this particular science, but having been brought up on it, they believed that its principles are the principles of all things. Now of these principles, numbers are naturally the first…in view of this, they took the element of numbers to be the elements of all things, and the whole heaven to be harmony and number… (9).

Leucipus and Democritus developed an important theory called atomism in the ancient period. Atomism is the view that all matter was composed of very small particles separated by empty space. (Thompson 13). They argued that if substance had different characteristics, it was because they were composed of different mixtures of atoms. They reached this conclusion through a reasoning process called induction. Induction is the process of reasoning that infers a general statement from a class of specific instances (Pence 28). Thompson articulates the inductive reasoning of the atomists as follows:

They saw that a substance can take on different forms -solid, liquid or gas, depending on temperature (as when water boils or freezes) and came to the general principle that the same atoms combine differently at different temperatures. In observing the world, looking for explanations for what they saw and moving from these to formulate general theories, these early philosophers were doing what we today recognize as science (13).

The above quotation clearly shows that the atomists laid the foundation for inductive method; a process that is certainly the hallmark of modern science. In addition, they utilized the principle of observation as the bedrock of the articulation of their theory. However, what they lack was any systematic or experimental method to confirm their theory.

In Aristotle (384-322 B.C) the process of scientific thinking became systematized. Aristotle argued that knowledge of the world comes through experience interpreted by reason; you need to examine phenomena, not turn away from them. (Thompson 14). As a result, Aristotle set out the different branches of science and divided up living things into their various species and genera. This process of classification is presently a major feature of modern science. In addition to the classification of things, Aristotle held that everything has a potential and a goal and that all occurrence are nothing but a process of actualization of a goal. Uduigwomen captures such Aristotelian classification in Biology as follows:

Aristotle bifurcated the physical world into organic and in organic. The former is marked by the possession of life or soul, and the later lack it. He classified living things in accordance with the amount of soul stuff they possessed. (Philosophy and the Rise… 197).

Aristotle's influence on science is not limited to the systematization of knowledge he also held the astronomical view that the earth is the centre of the universe, with the heavenly bodies rotating around it. That is, the earth was a sphere at a rest. The influence of Aristotle was so pervasive that all his thoughts were regarded as sacrosanct until the rise of modern science.

From the foregoing, it is clear that the pre-Socratics had speculated about the fundamental nature of things while Aristotle had developed key concepts and systematized the sciences. But, in the real sense of the word 'science', Archimedes (287-213 BC) stands out as the practical scientist among them all. He achieved this by using experiment and theory to solve practical problems. Let us consider one practical example to justify this claim. It is reported by Thompson that Archimedes was given a task to find out if a crown was made of pure gold or if it has been debased. According to Thompson:

In order to achieve this objective, Archimedes reasoned along the line of his usual experience during bath by observating how water displaced as he got into his bath, he had a simple method of measuring volume by measuring the volume of water displaced when the crown was immersed in a container full of water. He checked it against the displacement produced by an equal weight of gold, found that its volume was greater and therefore concluded that a lighter metal had been added (16).

From the above experiment, Archimedes reasoned from the usual bath to the theory of displacement of water which provided a practical answer to the task at hand. This is simply an eye opener to see the importance of experimentation in our quest for knowledge. This Archimedes achievement was based on pure physical and mathematical theories. And all these are central to the activities of modern science.

The medieval period emerged after Aristotle and it is usually referred to as the Dark ages. This is because during this period there was no clear-cut distinction between philosophy and theology. In fact, philosophy was more or less an instrument in the pursuit of the interest of theology. It was a period of intellectual darkness as a result of the sacking of the Western Roman Empire in 476 A.D by the Barbarian Goths (Uduigwomen 198). Uduigwomen further delineates the characteristics of this period as follows:
Learning almost came to a standstill, as virtually the whole body of ancient literature was lost. Philosophy was however kept alive by Christian philosophers who became channels through which ancient Greek works were transmitted to the west. (Philosophy & the Rise…198).

Although, there is nothing much in history in terms of the identification of features of modern science to be credited to the medieval thinkers, but it would be a mistake to underestimate the role medieval thinking played in making science possible (Thompson 17). Aristotle's philosophy was accepted as the great authority. His overall metaphysics was synthesized with the basic teachings of Christianity. The result turned out to be both intellectually and emotionally satisfying. The thinkers of this period looked at deductive reasoning (Syllogistic logic) and revelation as their sources of knowledge. From this standpoint they taught they knew the meaning and the purpose of their own lives and of the universe. What then is their main contribution to science? The main contribution of the scholastic philosophers and theologians to science was their idea of nature as a rational, orderly whole. This concept is basic to modern science. (Titus et al 220).

The synthesis of this period therefore lies in seeing the universe as a rational entity, established by an 'unmoved mover', protecting the human mind against the despair and nihilism of a world where everything is a product of chance. It offered an intellectual structure in which the human life has purpose and meaning. In line with this thinking, modern science looks at natural events as obeying certain laws and principles in nature. And as such, modern science seeks to unveil these natural laws and principles in order to establish theories that account for the operation of the natural world. This is another important defining feature of modern science. However, it is important to point out here that the medieval thinking was based on authority and religion, whereas, modern science is based on evidence and reason.

2. The Rise of Modern Science

In order to put this discourse in its proper context, it is imperative to situate modern science within the ambience of its emergence. This exercise will place us at a vantage point to have a clear picture of the rise of modern science against the cultural background that conditioned it. However, a detailed examination of the views of the modern thinkers will not be undertaken as the paper is interested in only identifying the defining features of modern science as obtainable in their views.

The emergence of modern science coincided with the Renaissance and the Reformation spirit of the 17^{th} century. At this period, there emerged in Europe a general appreciation of the value of human reason and its ability to challenge established ideas. Skepticism was widespread. The period witnessed political debate at every level of society, as witnessed in the Civil War in England and its aftermath. Consequently, the period witnessed the birth of new ideas, of individual liberty and of the overthrow of traditional authority, both political and religious (Thompson 21). With this background, the door was thrown open for scientists to engage in free rational explanation of the world. Thus, the origin of modern science lies in the period of rapid scientific development that occurred in Europe between the years 1500 and 1750, which we now refer to as the scientific revolution (Okasha 2). The change that took place in terms of the use of reason and evidence is what is generally referred to as the scientific revolution. It was Nicolas Copenicus (1473-1543) who took the first crucial step in the development of the modern scientific world-view, and for that, the first scientific revolution was seen as the Copernican revolution. In *De Revolution bu Orbium* (1542), he claimed that the sun rather than the earth was at the centre of the universe and that the Earth rotates everyday and revolves around the sun once a year. In addition, he noted that there was no *Stella Parallex*, in other words that there was no shift in the relative position of the stars when seen from widely separated places on Earth. He reasoned, from this that the stars must be considerably further away from the Earth than was the sun. Clearly, this went contrary to the geocentric or Ptolemaic astronomy which lay at the heart of the Aristotelian world-view which had gone largely unchallenged for 1,800 years (Okasha 3). Within Copernicus heliocentric model, the earth is regarded as just another planet, and so loses the unique status that tradition had accorded it as a result of threat from the Catholic Church who regarded it as contravening the scriptures. The preface of Copernicus' book had an inscription suggesting that it did not claim to represent the way things actually were in the universe, but merely a convenient alternative way of calculating planetary motion. However, the work did establish that, on the basis of careful gathered evidence, it was possible to put forward a theory that contradicted the accepted view of the universe.

Based on the above scenario, Francis Bacon (1561-1626) initiated what was to become the norm of scientific method, by insisting that all knowledge should be based on evidence and experience. In doing this, he rejected Aristotle's idea that everything had a final cause or purpose. Rather than observing nature with preconceived notions about what should be found, he started with the observation of individual things, and from them reasoned toward general principles. (Then, here lies the first conscious articulation of the principles of observation and induction as methods of science). Bacon went further to warn us about 'idols' that are barriers in the way of knowledge. Thompson highlights these idols are follows:

- The wish to accept whatever evidence seems to confirm what we already believed.
- The distortion that results from our habitual ways of thinking.
- Muddles that come from a careless use of language.
- Accepting the authority of a particular person or group (21).

It is important to note that Bacon saw mechanical causation throughout nature. That is, everything happened because of prior causes and conditions. This effectively ruled out Aristotle's final cause. Thus, things happened for reasons that lay in the immediate past, not goals that lay in the future. Consequently, for modern science, natural events must be studied from the conditions that led to them in order to be prepared for such events in the future (Thompson 21).

Copernicus' attack on the geocentric view and Bacon's articulation of the methods of science or how science should progress led to the development of modern physics including the work of Johannes Kepler (1571-1630) and Galileo Galilei (1564-1642). According to Okasha:

Kepler discovered that the planets do not move in circular orbits around the sun, as Copernicus thought, but rather in ellipses. This was his crucial 'first law' of planetary motion; his second and third laws specified the speeds at which the planets orbit the sun (3).

Galileo on his part was a life-long supporter of Copernicanism and in the spirit of the Baconian scientific system he employed the use of the telescope to prove what Copernicanism stands for. That is, the claim that nature operates in a regular, mathematical way. This achievement led Einstein to describe Galileo as 'the father of modern physics' (Thompson 26). Okasha captures the impact of Galileo's scientific achievement as follows:

When he pointed his telescope at the heavens, he made a wealth of amazing discoveries, including mountains on the moon, a vast array of stars, sun-spots, and Jupiter's moons. All of these conflicted thoroughly with Aristotelian cosmology, and played a pivotal role in converting the scientific community to Copernicanism (4).

The enduring contribution of Galileo to science is not even in astronomy but in mechanics. Here, he refuted the Aristotelian theory that heavier bodies fall faster than lighter ones. In place of this, he reasoned that all freely falling bodies will fall towards the earth at the same rate, irrespective of their weight. Furthermore, he argued that freely falling bodies accelerate uniformly, that is, gain equal increments of speed in equal times. This is known as Galileo's law of free-fall. In fact, to prove his case, Galileo conducted an experiment on the velocity of objects dropped from the Learning Tower of Pisa. Galileo's achievement in science can be summarized as follows:

He was the first to show that the language of mathematics could be used to describe the behaviour of actual objects in the material world, such as falling bodies, projectiles, etc… Another innovation aspect of Galileo's work was his emphasis on the importance of testing hypotheses experimentally… Galileo's emphasis on experimental testing marks the beginning of an empirical approach to studying nature that continues to this day (Okasha 5).

From the discussion so far, it is evident that the features of modern science is a gradual development of its methods from one stage in history to another. The above quotation in particular shows that all other developments and achievements in science are precipitated on the outlined features of science in the course of this discussion. Therefore, from the historical exposition of the development of science above, we can deduce or excavate the following defining features of modern science.

3. Features of Modern Science

From the foregoing, it is evident that although modern science was birthed out of the advancements of the renaissance and the age of reason, it is, however, a gradual process of development from the ancient period through the medieval period to a strong foundation in the modern period. Following this historical account of the development of science, it is clear that what is today known as modern science would not have been what it is, if its defining features had not been developed in one way or the other through the ages. It is on the basis of this that we took the pain in this work, to expose some of these features in their developmental stages in history. Thus, from our discussion so far the following defining features of modern science are deducible:

Inquisitiveness and Curiosity: This refers to the strong desire to know or unravel the reasons behind something. It is a thirst after knowledge. Modern science is constantly propelled into unraveling the secrets of nature through its undying desire to uncover the secret of nature. This leads to raising basic questions concerning a state of affair and it also defines the purpose of scientific research. For instance, a scientist may be curious to know the relationship between the colour of a bulb and the growth of grass seeds. As such, he would raise the question "Does the colour of a light bulb affect the growth of grass seed?"

Observability: This is central to any genuine scientific activity. As such, modern science is not an exception. As opposed to medieval science, which hailed theology and metaphysics as the principle of scientific knowledge, modern science only references natural objects which can be perceived by the five senses or can be perceived with the aid of instruments. So, observation is a matter of sense perception: we see, hear, touch, feel or smell something. On the basis of our observations we draw conclusions regarding relations, causal sequences, and the meaning of the situation. (Titus et al 223). Modern science emphasizes the act of watching something carefully for a period of time, in order to learn about it.

Formulation of Laws and Theories: Once facts have been observed, tested and re-tested, scientists try to arrange their observations in the format of expressions referred to as scientific laws. Observations which cannot yet be tested and proved on a consistent basis are referred to as scientific theories which are subjected to future tests for confirmation or otherwise. This explains why the postulations of the ancient Greek philosophers were regarded as scientific theories as they were observations that were at that time yet to be tested and proven.

Hypothesis Formulation: On the basis of observation and the derived laws scientists put up hypothesis in order to predict the outcome of a particular test or problem. Another term for hypothesis is 'educated or informed guess'. Hypothesis is therefore an idea or explanation of something that is based on a few known facts but that has not yet been proved to be true or correct. In other words, a hypothesis is a sort of draft law about what the world – or some particularly interesting aspect of it is (Medawar 84). This is usually stated like "if I… (do something) then…(this will occur)". For instance, "if I grow grass seeds under green light bulbs, then they will grow faster than plants growing under red light bulbs".

Experimentation: Here, scientists design a test or procedure to find out if their hypothesis is correct. In our example under hypothesis (item 4). Scientists would set up grass seeds under a green light bulb and a grass seed under a red light and observe each for a couple of weeks. They would also set up a grass seed under regular white light so that they can compare it with the others. This manipulation and control of the environment of the object of study is basically what is referred to as experiment in science. It is central to the practice of modern science.

Mathematics: A strong emphasis on mathematics is another central feature of modern science that goes hand-in-hand with observability and experimentation. This is derived from Galileo's successful utilization of mathematical principles in presenting a superior conception of the universe (heliocentricism) as against the Aristotelian Ptolemaic conception of the universe (geocentricism). Consequently, Galileo's use of mathematics sparked the replacement of speculation with objective observation. Isaac Newton, one of the fathers of modern science, further solidified the importance of mathematics in theorizing that the entire universe could be explained through the use of mathematical models. In a more practical term, mathematics as a feature of modern science involves the use of statistical method. The term 'statistics' refers to the science of the collection, analysis, and classification of numerical data as a basis for induction. With the use of statistics, science helps us to predict the probability of events, to explain causes and effects, to describe type of phenomena, and to make comparisons through the use of tables, charts, and graphs (Titus et al 226).

Classification of the Sciences: Modern science can be divided into two different classes, which are known as applied science and pure science. Pure science describes the science of discovery. Applied science describes the process of developing new technology and products for consumers and often results from the experiments and theories of pure science. While both classes of science utilize the powers of observation, experimentation and mathematics, pure science is more concerned with expanding and testing the existing body of scientific knowledge while applied science seeks to put that knowledge to use.

The Inductive Method: The rise of modern science was characterized by a new seriousness with which evidence was gathered and examined in order to frame general theories. This process which is termed 'inductive inference' is the attempt to move from singular statements (that is, statements about things) to general or universal statements about the world, which could take the form of 'laws of nature'. This form of reasoning distinguishes modern science from what had gone before it. Central to the inductive method is the idea of sampling. This involves taking the nature of certain numbers of a class as an indication of the nature of the whole membership. This is based on the idea that if an experiment is performed only once, one may be uncertain of its results. If it is performed it 100 times, with the same result each time, one becomes convinced that the same result will be obtained every time it is performed. So, on the basis of selected cases a general conviction is drawn.

Instrumentalism: Instrumentalism as a feature of modern science can be understood in two senses. On the one hand, it refers to the use of instruments to enhance the senses in the observation of nature as evident in Galileo's use of the telescope in the study of planetary systems. On the other hand, it is a kind of anti-realistic view of scientific theories wherein theories are construed as calculating devices from a given set of observations to a predicted set of observations. (Audi 379). In other words, it refers to a conception of scientific theory as tools for predicting future occurrences. As such, it sees science in terms of its usefulness and ability to solve puzzles. This means that modern science is definable from a pragmatic rather than an absolute approach to truth.

4. Conclusion

Our discussion so far in this paper has shown that what constitutes science in the modern sense of the word is centred on the highlighted features above. That is, for any activity to be described as science today, it must possess the features discussed here. This is not to say that the paper has exhausted the defining features of modern science, but other features that may be identified are still part and parcel of the above identified ones in one way or the other. As such, the features pointed out in this paper can be regarded as the basic and most fundamental features of modern science. Consequently, this paper submits that any discipline worthy of the name 'science', must as a matter necessity, be definable within the limit of the above stated features in the final analysis.

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