

growing evidence in our society of a casual approach to the values of accountability to one's professional commitments, of which teacher absenteeism and lack of performance is but one manifestation. A possible reason for this is that with the steady break-up of family traditions and the growth of crass commercialism in the ranks of the middle-class, under the onslaught of modernism, children get fewer and fewer opportunities to imbibe good values at home. In schools, the other source from which children could pick up good values, the situation is bedevilled both by the bad example that teachers often set and also by the problems associated with formally teaching morals and values in a multi-cultural and multi-religious society. Whose morals and whose values do you teach? And because such questions have traditionally been rooted in religious discourse, there have been no commonly acceptable answers and we have ended up teaching none. I think the time has come to locate such discourses outside religion and develop a basis that is founded on reason and rationality for the teaching of such subjects in school. Hopefully, having to teach such courses and being exposed to such discourses, will bring about a change both among the teachers as well

as the general population, leading to a greater commitment to professionalism and accountability - ends which are much to be desired.

To summarise, what we have argued in this brief article is that good and committed teachers are central to a good system of education in schools. Teachers should have a greater role in the development of syllabi and textbooks and for this, these processes need to be decentralised. We must also attract better quality people into the profession and for this, we must not only improve salaries but also the working conditions of teachers and the facilities available to them. However, all this will come to nothing unless we simultaneously improve teacher accountability by both legislative processes as well as by inculcating a proper sense of values in our teachers and our students through our system of schooling.

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HISTORY OF SCIENCE

Journey Of Science Through Time

Nandita Narayanasamy



Trying to organise my thoughts about the history of science, the first thing that sprang to my mind was the current advertisement of a health drink for children. The advertisement states that Nature and Science are present together in the product which accounts for its superiority as a nutrient supplement! The company makes us believe that Nature provides the complex nutrients and it is Science that provides the minerals. If one applies logic, to this otherwise illogical advertisement, the outcome is that minerals are not

part of nature! Pardon my ignorance, but I was under the impression that Science has always been the study or enquiry into the workings of Nature! If one looks back in literature, both European and Asian, the close association of the awe of nature and mankind's quest to understand and harness its power is very apparent. This whole episode made me introspect on our understanding of science and how this perspective has changed with time.

The word science comes from the Latin word, "scientia", meaning knowledge. Science is the effort to

discover and increase human understanding of how physical reality works. Science is the total collection of knowledge gained by observation of the physical world using our five senses, to investigate the world that exists in the present. If one looks into the Oxford Dictionary, science is defined as the intellectual and practical activity encompassing the systemic study of the structure and behaviour of the physical and natural world through observation and experimentation.

Tracing the exact origins of modern science is possible through the many important texts which have survived from the classical world. Many ancient civilizations collected astronomical information in a systematic manner through simple observation. Though they had no knowledge of the real physical structure of the planets and stars, many theoretical explanations were proposed. Basic facts about human physiology were known in some places and alchemy was practiced in several civilizations. From their beginnings in Sumer (now Iraq), around 3500 BC, the Mesopotamian peoples began to attempt to record some observations of the world with extremely thorough quantitative and numerical data. The pre-Socratic philosopher, Thales, dubbed the "father of science", was the first to postulate non-supernatural explanations for natural phenomena such as lightning and earthquakes.

While such empirical investigations of the natural world have been described in various ancient civilizations, including Ancient Greece (for example, by Thales, Aristotle and others), records of the use of scientific methods having been employed appear in the Middle Ages. Ancient India was an early leader in metallurgy, as evidenced by the wrought iron Pillar of Delhi. They excelled in the manufacture of iron, and in the preparations of those ingredients with which it is fused, to obtain that kind of soft iron which is usually styled 'Indian steel'. They also had workshops wherein the most famous sabers in the world were forged. Ancient China was home to four great inventions: the compass, gunpowder, papermaking and printing.

However, the dawn of present-day science is generally traced back to the early modern period, during what is known as the Scientific Revolution, which took place in the 16th and 17th century, in Europe. Also, the word scientist is relatively recent - first coined by William Whewell in the 19th century. Previously, people investigating nature called themselves natural philosophers.

Scientific methods are now considered to be so fundamental to modern science that some people, especially philosophers of science and practicing scientists, consider earlier inquiries into nature to be pre-scientific. Traditionally, historians of science have defined science sufficiently broadly to include those inquiries.

A broader, modern definition of science may include the natural scientists along with the social and behavioral sciences, defining it as the observation, identification, description, experimental investigation, and theoretical explanation of any phenomena. However, other contemporary definitions still place the natural sciences, which are closely related with the physical world's phenomena, as the only true vehicles of science.

One overriding sentiment that runs through the above narrative is the emphasis on observation. Scientists are expected to be unbiased observers who use the scientific method to conclusively confirm and/or conclusively falsify various theories. These experts should have no preconceptions in gathering the data and should logically derive theories from objective observations. Another great strength of science is that it is self-correcting, because scientists readily abandon theories when they are shown to be irrational.

Science should therefore be, in my opinion, a project whose goal is to obtain knowledge of the natural world. To me, science is a way of life that encourages thought and promotes a sense of healthy enquiry into any aspect that touches human existence. However, a philosophical definition of science would be that it is basically an ordered and studied matter of questioning. And the pursuit of science has to be the

pursuit of understanding, leading to further in-depth questioning.

However, today's Science Education, particularly in India gives scant importance to both observation and enquiry. In fact, both these necessary capacities are progressively discouraged in students, reducing them to a band of unthinking zombies, incapable of any analytical abilities. Science, unfortunately, has been reduced to a mere subject, a part of a curriculum that encourages information retrieval rather than exciting enquiry. A student of science is expected to be primarily hardworking, a conformist, non-rebellious and compliant. A child who is fun-loving or a dreamer, with revolutionary ideas and who asks uncomfortable questions is discouraged and thought 'unsuitable for science'.

If one looks back into the aforementioned advertisement, the depiction of science is that of a robot. Here, we arrive at another affliction that torments science nowadays - science has become synonymous with technology. The history of science has been marked by a chain of advances in technology and knowledge that have always complemented each other. But, one needs to remember, they are two independent entities, and technology is the outcome of science that supports further understanding. For a long time now, in India, technology has always had a superior edge over the pure sciences which accounts for the rush for engineering over a B.Sc. degree. This attitude in society has not changed; recently a student of mine left a B.Sc. Honors course in Delhi University to take up an engineering course in some god-forsaken private engineering college in interior Uttar Pradesh: the reason being, it would improve her prospects of obtaining a suitable groom in the marriage market!

Leonardo da Vinci may seem an unusual person to bring up when talking about science. But the more one learns about this remarkable Renaissance polymath, the more one realizes that he was a terrific role model for applying the scientific method creatively in every

aspect of life, including art and music. Although he is best known for his dramatic and expressive artwork, Leonardo also conducted dozens of (carefully thought out) experiments and created futuristic inventions, at a time when modern science and invention had not really begun. Leonardo's approach to science was an observational one. He tried to understand a phenomenon by describing and depicting it in utmost detail, and did not emphasize experiments or theoretical explanation. As usual, because he lacked formal education in Latin and mathematics, contemporary scholars mostly ignored Leonardo, the scientist.

The reason for the story of Da Vinci is to emphasize the demarcation that has infiltrated our pursuit of knowledge. The arts and sciences are not expected to mix, they are mutually exclusive! Furthermore, the sciences themselves have been shredded into innumerable sub-fields, each maintaining their own snooty distance from each other. Thus the social perception of a scientist in India today is that of an asocial, non-creative entity who remains boxed in her/his own unreal world of the laboratory, the very thought of which is enough to drive off students from the field, in droves.

Thus the journey of science that began as an integrative understanding of nature has deteriorated into an unhealthy amalgam of 'subjects' that maintain a parochial disdain for each other. The positive note is that we have diagnosed the problem and that is the first step towards treating the malady. The following words of the great scientist Albert Einstein should guide us in our pursuit of knowledge: "A little knowledge is dangerous, so is a lot of knowledge, but the main thing is never to stop questioning."

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