SEAMLESS SCIENCE:TEACHING, LEARNING AND PRACTICE, FERGUSON COLLEGE, PUNE

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Science and technology has changed the face of this world beyond recognition. In one hundred years, our knowledge base gas grown several folds, Fifty years ago, the best knowledge resource was Encyclopedia, Britannica, twenty-four volumes in all and the repository of world's information. Today, the entire Encyclopedia Britannica occupies less than half a GB in a computer disc.

At the beginning of 1900, several technology revolution excited our forefathers. Incandescent lamp, steam engine, printing press, and automobiles. They allowed movement of people and ideas, creating for the first time, a generation capable of interacting with each other. Land, natural resources, labour and capital dominated both economics and politics. New nations were born out of political ideology and old nations sought domination leading to two world wars. Once again technology provided nations with the power to eliminate the enemy. From gun powder to nuclear fission, from steel to rubber tyres, from telecommunication and wireless communication to synthetic fibers and fabric that could be used to make parachutes, were all products of this need created by nations at war with each other.

Science and technology spawned a production industry – which lasted for over one hundred years. In mid 1995, internet technology became prevalent – enabling instant, anywhere transactions. Interestingly, we just celebrated fifteenth anniversary of the world wide web. From a focus on production or transaction, we are moving into an interaction based world with global networks. Complex interactions are leading people to indulge in value added interactions.

An interaction based economy calls for knowledge workers. If we are to succeed in this new economy, we need to go back to our roots in education. The internet extends education, communication and commence to anyone with a network and makes time and place irrelevant crating not only a world that is flat but a playing field that is now globally level. Today we live in a world where our children are riveted to interactive gaming, instant messaging, cell phones and i-pods, yet are generally uninterested or unaware of the technologies that enable these interactions. As educators and scientists, we must engage our imagination and resources toward sparking interest and providing

education that will enable them to appreciate better the world we live in, the gadgets we use and the technology that drives our civilization today.

The first step towards realizing this goal is to understand the seamless nature of modern science and technology. The unraveling of the molecular basis of human genetics, the DNA, by Watson and Crick, fifty years ago, demonstrated that all biological process have a chemical basis. Since then, every major discovery of science has brought out the unit of science.

Yet, science education in our universities is highly fragmented. Subjects are taught in isolation and science appears to the student as a bunch of isolated facts and principles. Much of the basic principles of science are manifested, in life's processes, in the materials we use, the energy we consume and in the environment around us. Yet, the chemistry or physics we learn is hardly linked to these vital manifestations of science. Science is becoming increasingly move interdisciplinary pursuit, yet students learn the subject in isolation. When one performs research or looks at nature, we do not see chemistry, physics or biology.

Separately, yet we do not teach science the way we actually practice it. Science must also be taught not as a set of facts, but a set of approaches. Students must imbibe "scientific habits of mind". We must communicate that real world problems have more than one correct answer and an ability to search for truth is the hallmark of a scientific mind. Einstein once remarked "most teachers waste their time asking questions which are intended to discover what a pupil does not know, whereas, the true art of questioning has for its purpose to discover what the pupil knows or is capable of knowing". Topics such as astronomy, environmental sciences, biodiversity, neuroscience, nanoscience and biophysics are important to communicate how new understanding of our physical world occurs at the intersection of disciplines. We must also recognize that science, in the ultimate is a discipline of senses. Power of observation is the key to understanding science. Science must be seen, felt, smelt, touched and experienced. Textbooks alone cannot communicate science. Creative experimentation, field visits, ability to do things by ones own hand are all important to learning science. Research must be integrated with teaching at a very early stage. Practice must be integrated with learning in early years of ones life.

All this will require radical changes of how our science curriculum is currently structured. Teaching of science should become seamless and boundary less. This will need a new breed of teachers, who appreciate the unit of science. Entirely new set of teaching tools, including books, which convey sciences in this fashion, must be created. Chemistry or biology cannot be taught only by a chemist or biologist. They should partner together in teaching either chemistry or biology.

India has survived with an increasingly mediocre higher education in science. One reason for declining interest amongst our young people to pursue science as a career is the archaic syllabus, fossilized teaching methods and lack of sufficient number of inspiring teachers, who can ignite young minds. If one asks, any great scientist, the

question, what made him pursue science as a career, invariably one will get the answer, an inspiring teacher in high school or in undergraduate college. No amount of money or infrastructure can replace the inspiring teacher who can kindle the fire of inquisitiveness in young minds. In the end, what is important is the power of imagination, not knowledge.

To compete successfully in this century India needs a higher education system that is alive to these needs. Sophisticated research, and scientific scholarship must be encouraged. This is the task of public universities. Private universities will not undertake the task of instruction in man stream arts or sciences discipline. Only public institutions, with sustained state funding, have the potential to be world-class institutions. Such public institutions must be created upon a clearly differentiated academic system which recognizes both the need for equity and merit. India must build several such world-class institutions. Without them India will be destined to remain the back office of the world and in scientific backwaters.