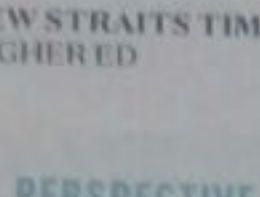
PERSPECTIVE

# Learning in a world of borderless knowledge



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*We live in an era of rapid knowledge acquisition and technology evolution, thus it becomes necessary for not only scientists but also the general workforce to constantly adapt.*

KNOWLEDGE and science did not originally have boundaries that delineate our understanding into disciplines such as mathematics, physics, biology, chemistry, history, etc. The earliest scientists were polymaths who studied and described the world they lived in without lumping their description into something being a part of any particular discipline.

For example, when we study life, we tend to think of it as the discipline of biology. But, it is not just biology. Life is about how the component molecules that enable life interact with each other and carry out the functions — this is chemistry. These interactions and functions must conform to the laws of physics that can in turn be described or explained using mathematics.

We are now approaching science, and to a greater extent, the experience and process of learning itself, without too much emphasis on compartmentalising them. As we move forward into the 21st century beyond 2020, this integration of knowledge and the implementation of multidisciplinary approaches towards solving the problems that plague humanity will feature even more prominently.

I usually describe myself as a bioinformatician and molecular biologist. Not being a very articulate person, explaining what I do is difficult even to those familiar with academia. I sometimes try to find common ground by explaining what I do differently to different people, depending on what I perceive as the best context for them to understand.

For example, if I were to meet someone from the medical field, I would say something along the lines of "I study bacterial infectious disease", "I work on drug discovery", "I do genetics work" etc. When I meet someone who works in information technology, I might say "I work in information science/data science/big data", while if I were to meet someone with an engineering background, I might offer that "I work in high performance computing". You're probably thinking that I must be very confused with myself or have multiple personality disorder.

Since I don't have multiple personality disorder (at least I hope not), am I perhaps some kind of narcissist who thinks he can do everything? ("Narcissist" seems to trump other words recently that I cannot resist using it here too.) The answer to that is also "no". I am also not one of those rare gifted individuals who wake up one morning at the age of 10 and solve advanced calculus problems while at the same time find the cure for cancer and build nuclear reactors.

> *"We should not cloister knowledge into boxes with no interactions between them. We should not limit our knowledge and skill sets to what degree we read in university."*

How can I claim to "do" or be involved in all those areas of study? My main research interest is the understanding of molecular level mechanisms that control biological processes and functions. What does that even mean? Take, for example, a disease caused by a bacteria. In such a case, my interest is to find out how an organism, which we cannot even see with the naked eye, can be fatal to a healthy human being. What chemicals or toxins can the bacteria produce that can cause death? What triggers the release of the toxin(s) and what switches it (them) off? Are there weaknesses in the biology of the bacterium that we can exploit to kill it?

Such research will require understanding the genetics of the bacteria and the human host. One way of doing that is by decoding the information contained in the genome or the total genetic content of an organism. The genome is the blueprint that makes a living thing what it is. Decoding the genome uses information science for sifting through a lot of data to hopefully get a biological understanding of the organism. Extracting useful information from large amounts of data (or big data analytics, as it is more sexily called nowadays) involves mathematics and the skills to write computer programs to extract insights from the data. Such data processing also requires substantial computing power — thus the need to use high performance computing such as supercomputers.

I have also used intense X-ray beams to determine the molecular structures of proteins, such as a toxin. This method uses a particle accelerator called a synchrotron and can provide a picture of what the molecule looks like up to the location of each atom. By knowing the toxin in such detail, we can then perhaps find or even design a drug that can stop the toxic action of the molecule.

So, although I do work on infectious diseases, genetics, chemistry, information science etc — I am simply trying to understand and solve a problem. Obviously, I do not have a university degree in all those fields. The additional knowledge and skills were acquired via self-learning necessitated by the need to solve a problem. The diverse knowledge and skill sets are directed towards a particular objective, be it to answer a question or find a solution.

We live in an era of rapid knowledge acquisition and technology evolution, thus it becomes necessary for not only scientists but also the general workforce to constantly adapt and evolve. This can be achieved by ensuring that learning does not stop when one leaves formal education. We should not cloister knowledge into boxes with no interactions between them. We should not limit our knowledge and skill sets to what degree we read in university.

Although my example may be a bit on the extreme side, many occupations now require diverse knowledge base and skill sets. Employees must take the initiative to learn, adapt and deliver. Not having the training or knowledge to do something is no longer an excuse. The aim is not to replace experts in a particular area but merely to facilitate your needs to achieve specific work objectives.

To this end, many universities now offer programmes for continuous education, which include single courses available online via the massive open online courses platform, short courses and postgraduate programmes. There is no stopping an engineering graduate to undertake postgraduate qualification in writing and journalism or psychology. Continuous and self-learning is now a reality accessible at the click of a button. Evolving ourselves to rapidly changing work environments is a necessity, but it is also facilitated by the easy access to educational resources from all over the world.

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