Education: A life-long process

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“If you think education is expensive, try ignorance.”
- A radio advertisement.

Zero In The Adding Machine

Boss: The fact is that my efficiency experts have recommended the installation of adding machines.
Zero: Addin’ machines?
Boss: Yes, you’ve probably seen them. A mechanical device that adds automatically.
Zero: Sure. I’ve seen them. Keys – and a handle you can pull.
Boss: That’s it. They do the work in half the time and a high school girl can operate them. Now, of course, I’m sorry to lose an old and faithful employee…
The exchanges are an excerpt from Elmer Leopold Rice’s 1923 play, The Adding Machine. The protagonist is a veteran department store bookkeeper named Zero. In one of the scenes, he expects to be promoted, but instead is startled to learn that he is to be replaced by an adding machine. The play just keeps becoming more timely, more apt and more disconcertingly relevant as we march, or to be more precise, are dragged deeper and deeper into the information age:
Update this! Upgrade that!
Download this! Upload that!
Online! Offline!
Internet! Intranet!
Your 750Mhz Pentium III will be obsolete before the end of the year and you with it!
Personal digital assistant (PDA)
…
and the like.
Of Apes In Education

In incremental change, it makes sense to ape the elders in order to take over where they leave off, in both knowledge and responsibility. But under rapid change or discontinuity, such as what we are experiencing now, it is no longer obvious that the elders’ ways should continue to be the ways for new rules are normally needed for new ball games and we will have to discover the new rules. Learning then becomes a voyage of exploration and of experimentation that scientists and children know it to be. This way of learning is often admonished by parents, teachers, and supervisors, who believe not to waste time when others already know what we need to learn. It is a way of learning that is seen as disrespectful, if not downright rebellious.

To learn, we need education. Education and training are not the same. Education, formal or informal, is the only way to develop the qualities that equip us to handle change and ambiguity effectively, intelligently and responsibly. Training, on the other hand, is the acquisition of skill and information that leads us to deal effectively with the basics. If we need to operate a computer, we need training, not education. It is the greater part of applied science and engineering and of all specialization. It is the continual unfolding of the human being as homo faber (the tool man).

In his annual message to the U.S. Congress in 1907, President Theodore Roosevelt (1858–1919) said, “Our school system is gravely defective in so far as it puts a premium upon mere literacy training and tends therefore to train the boy away from the farm and the workshop. Nothing is more needed than the best type of industrial school, the school for mechanical industries in the city, the school for practically teaching agriculture in the country.”

In the early 1900s, progress was made more slowly. Training was sufficient for a reasonably comfortable career.

Half a decade later, Sir Winston Churchill (1874–1965) said, “The first duty of a university education is to teach wisdom, not a trade; character, not technicalities. We want a lot of engineers in the modern world, but we do not want a world of engineers.” At first glance, this statement seems to contradict what Roosevelt had to say half a century earlier. Roosevelt was talking about training, while Churchill was talking about education.

In times of rapid change or disequilibrium, only a prior education will equip us with the knowledge to handle the situation effectively. Training will not be adequate for rapid change. Training is for the routine.

Education has to be the most important investment that any person can make in one’s own destiny. In this new world, education will not be, however, the old-fashioned education as most of us know it.

The Learning Treadmill

We learn in education. Charles Handy views learning as a wheel with four parts: questions, theories, testing, and reflections. One set of questions, duly answered, tested and reflected upon, leads on to another. So it goes round and round like a treadmill.
Logically, the wheel starts at question, a problem to be solved, and a challenge to meet. It is easy to see why this is so. It has to start here. Otherwise it is not our question and the wheel will never be pushed to the final stage. If it is someone else’s question, it is likely that we will forget about the question as soon as we find an answer to it, unless the question intrigues us so much that we take upon it as our own question.

The wheel has a lot of inertia. It is difficult to begin turning. For some people, it never gets started. They have no questions and therefore need no answers. For some, they get stuck at the question stage. Like small inquisitive children, they derive pleasure in asking why, how, when and where, and as long as they get an answer, any answer, they are satisfied, for it is the questions that fascinate them, not the answers. They usually do not learn, and others do not learn from their, sometimes annoying, questions either. These are life’s inspectors or auditors. They are nice to have, no doubt, but can be extremely irritating at times. Some armchair philosophers belong to this category.

The next stage, theory, has its own specialists. These are bad academics hiding in their ivory towers, full of explanations and answers to other people’s questions. They teach the answers first and assume the questions. Knowledge for its own sake is what motivates them. They are fact collectors who know a lot, but learn little in the fuller sense. A cult leader often belongs here. He or she has all the answers to the world.

The testing stage has its own enthusiasts, the action men or pragmatists. They have no time for theory or for thinking. Their immediate reaction to a problem is to attack it with the tools nearest at hand. The approach may work, but they do not know why. Success without prior thought or subsequent reflection does not help the pragmatists to duplicate the result or to improve upon it. These pragmatists find it difficult to communicate their secret to other people. A technician with no formal education may fall in this group. He or she knows how to operate a machine, but never understands how the machine works.

Lastly, there are those who get stuck at the reflection stage. Endlessly they rehearse the past, seeking better explanations of what went wrong or what went right. They have learnt because they have gone round the wheel, but they have stopped. They sometimes rest on their own laurels. They form their opinion long before and see no cause to change them. If we concur with them, we are consistent. Otherwise, we are bigots. Many analysts and legal professionals are in this group. They look to precedents and argue to their death.

When Hal was young, every morning the world’s greatest mom would wake up before daybreak, make Hal breakfast so that he would last five hours of school. At school, Hal, with fellow classmates, would be seated neatly and the teacher would write theorems, formula and equations for them to learn by heart. A few weeks later during an examination, if the students could reproduce the same theorems, formulae or equations, then Hal and classmates had learnt and they would pass the class. The better the
students could reproduce, the better their grades would be. Learning is equivalent to transferring answers from teachers to the students.5

Later, as Hal progressed further along, Hal discovered that life was not always that simple. First, all Hal had learnt at school had been solved by someone. Second, all the problems Hal and fellow students had solved were ideal problems. In graduate research days, Hal found that if a problem has a closed form solution – that is, could be expressed in a concise mathematical form – then he was extremely lucky to have hit on something and he should rush to publish the result. But it is likely that someone had already solved it as well, may be in some obscure journals or in another language like Chinese, French, German, Japanese, or Russian. For problems that have no closed form solutions, Hal resorts to computer simulations, using various approximations. Depending on the capacity of the computer available then, Hal and fellow peers tried to furnish the most accurate solution they could offer. But this is not learning.

In the sense of the treadmill of learning,

- Learning is not just knowing the answer. Just knowing the answer is mastermind learning at its best, rote learning at its most boring like in the TV game show Who Wants to be a Millionaire, and conditioned response at its most basic like most cult followers blindly following their leaders.
- Learning is not the same as study, nor the same as training. Learning is not measured by examinations, which usually test only the theory stage.
- Learning is not automatic. It requires energy, thought, courage and support.
- Learning is not only for the intellectuals, who often shine at the theory stage. They are usually not curious or adventurous and therefore add little to their experience as they go through life.
- Learning is not finding out what other people already know.

A psychologist’s definition of learning is considerably broader than a layperson’s view. A layperson views learning as “it is what we did when we went to school.” In actuality, each of us is continuously going “to school.” Learning occurs all the time.

**Capability Versus Copability**

The typical school does not really regard its students as workers. Nor are they the customers, for they have no choice, no customer power, and no right to complain or to be asked for their preference. Schools do not do much market research among their students.

Instinctively, schools see their students as products. Organisationally, that makes sense. Products start off as raw material. The material is processed, in batches usually, at different workstations. It is graded and inspected in quality control. So are students. Unfortunately, the inferior batch of students is not sent back for further processing but instead, is turned out to fend for themselves in the workplace.

Identifying students as products may be the very reason why alumni associations are so popular. People are labeled by which school or university they once went to. It is good to identify oneself with one’s alma mater, but it will be stretching to identify oneself as a product.

Alumni associations provide former students the opportunity to network. Graduates from prestigious schools, such as Harvard, MIT, Stanford, Berkeley, Princeton, Cambridge University, Oxford University, Imperial College of Sc. Tech & Medicine and others enjoy many competitive advantages in the workplace:
An excellent credential because the reputation of their alma mater itself is good enough to attract for them careers unreachable by others.

A proven willingness to subordinate themselves to collective enterprise.

A network of former classmates and alumni to help each other to further their respective career.

Prestigious schools have better environments and resources to prepare their students. Their students are more likely to be very capable, which is not necessarily the same as copable (derived from “cope”).

When routine, no change or gradual change predominates, the challenge is to be sure that we have the appropriate specialists on staff to engineer and optimize the constant and predictable solutions. We develop formulas, principles, rules and methodologies, and seek predictability and excellence in continuous recurrence. In such situation, we need capability.

But in rapid change and the action of the dynamic world, we must continuously create new solutions for every new problem. In this situation, we need capability. We must be able to cope with the rapid change.6

To reiterate, in gradual change, we need capability; in rapid change, we need capability. Judge Ben Lindsey once made this request, “I do beseech you to direct your efforts more to preparing the youth for the path and less to preparing the path for the youth.”7

Educating Young Netizens To Swim In The Net Pool

Education goes beyond the boundaries of schools, universities and learning centers. As technology advances and the society changes, we will have to constantly reeducate ourselves. We will also have to educate the innocent and vulnerable young to not only to be intelligent users, but also responsible users of the new tools.

The computer is a major tool in modern day education. Innocent young netizens – citizens of the Internet – are constantly tempted to stretch limits of the terra incognita or are exposed to objectionable materials. The Internet is such a democratizer that the situation can be paralleled with giving every student a car without providing drivers’ education classes to teach them the rules. This has created some immediate problems.

The rush to the online world has created a population of ever-younger computer victims and computer pirates. As children have access to computers earlier and earlier in their educational careers, experts in piracy, hacking and other forms of Internet mischief are looking at younger crowds to stop Internet pornographies and to tackle the illicit trade of digital goods – including video games, computer software, music and movies.

One of the most thorough reports ever produced on protecting children from Internet pornography has concluded that neither tougher laws nor new technology alone can solve the problem.8 In “Youth, Pornography and the Internet”, issued by the U.S. National Research Council on May 2, 2002, the authors wrote, “Though some might wish otherwise, no single approach – technical, legal, economic or educational – will be sufficient. Rather, an effective framework for protecting our children from inappropriate materials and experiences on the Internet will require a balanced composite of all of these elements.”
What might seem a rather bland conclusion is actually a surprising stand. It does not call for legislation to solve this problem, despite a strong push in the U.S. Congress to pass laws requiring technology tools like pornography filters in schools and libraries.

The language of the report is meticulously balanced but wryly conclusive. Filters intended to block pornographic sites can be highly effective in reducing the exposure of minors to inappropriate content if the inability to access large amounts of appropriate material is acceptable.

The report compared the problem of protecting children from online risks to dealing with a more mundane hazard of daily life. “Swimming pools can be dangerous for children,” the authors wrote. “To protect them, one can install locks, put up fences and deploy pool alarms. All of these measures are helpful, but by far the most important thing that one can do for one’s children is to teach them to swim.”

A related problem to Internet pornographies is Internet piracies.

Online searching and trading for wares goes on continuously. In a normal online discussion using technology known as Internet Relay Chat, the “warez” channel, or chat room, is inundated with exchanges. Warez is slang for software that has been liberated from encryption.

On the channel, requests for digital goods – games, DVDs, business software and others – were interspersed among the random comments and insults. The patter and trading are constant. Yet this is relatively small time. Far bigger players operate quietly with vast storage and bandwidth, cracking copyright protection and making the loot available.

If students lack the ethical preparation when they begin using the Internet, things quickly spiral out of control when they reach university. In university they have lots of free time, peers they want to impress and high bandwidth. This is to be expected since university is a time for testing boundaries such as trying new things and meeting new people. It is not that surprising that they try to break some of the bounds, not just in computing.

But there is no easy way to fix the problem. Fixing the problem would be expensive and intrusive. The monitoring required might be worse than the disease. For example, if a person out of 50,000, or 0.002 percent is bad, do we want to watch the other 49,999 to catch that rotten apple that spoils the barrel? Thus, finding the people doing the bad things might involve violating the privacy of all those other innocent people. As a society, is this the kind of trade-off we want to make?

Thus, law enforcement agents are always one step behind. By the time law enforcement agents crack a case, the young criminals already believe it is right in doing what they are doing. In other words, if they can bootleg music, they can bootleg anything.

Experts believe that the focus should be preparing the kids to use the Internet in a safe and responsible manner. Countries like the U.S. enact the Children’s Internet Protection Act which requires schools and libraries to use filters or similar technology to protect children from objectionable materials. It also requires an Internet safety policy to prevent unauthorised access, including so-called hacking, and other unlawful activities by minors online.

**Back To Zero**

We now return to the play in the opening paragraph. Elmer Leopold Rice hit his stride in 1923 with *The Adding Machine*, a dark satire of Mr. Zero, a man who is replaced by a machine after 25 years of diligent service with a company.
The play examines the role that technology plays in our everyday lives. Mr. Zero loses his job because he is replaced by an adding machine. Fundamentally, this is the same situation that occurs when a factory worker loses his or her job because a new automated machine can perform his or her job more cost effectively. Is this a new dramatic situation brought on by the Information Revolution? Elmer Rice would answer no as his play carefully reveals that Mr. Zero’s reincarnations throughout time have always been replaced by different machines, all the way from the wheel to the adding machine.

In the real world, the new technology of the office allows ordinary less educated workers to replace the better-educated workers. Anxiety about the impact of automation rises, particularly among people whose jobs are at risk. Even as office machinery eliminates some jobs, it lowers the cost of information gathering, analysis and dissemination, thereby sharply increases the demand for workers who can use machines.

The bottom-line is that we have to constantly master our trade. Education is a life-long process, and we have to be a transformed specialist every so often, in sync with technology changes. We have to constantly change ourselves to be productive and be indispensable.

If knowledge is an artifact and innovation is the result of interaction on the web of change, then the way for us to better manage change is to become acquainted with the interactive process. In a future world changing too fast for the old fashion, specialist approach to education, it may benefit us to require young students to journey the web of change as a primary learning experience. Schools must educate their students to weave their way idiosyncratically through the web of change, imagining their way to solutions, rather than learning by rote lists of data that will be obsolete before they can use them.

In this sense, the definition of intelligence must be restated. Instead of judging people by their ability to memorize, to think sequentially and to recite good poetry, intelligence may be gauged as the ability to connect the seemingly unrelated isolated islets of information and to put the whole thing in proper perspective. An intelligent person is a generalist with a specialty. Being a consummate generalist the intelligent person knows how to connect islets of information from many diverse areas and apply in the field for which he or she is a specialist.

References

1. This article is extracted from Hwa A. Lim, CHANGE: in business, corporate governance, education, scandals, technology and warfare, (EN Publishing, Santa Clara, USA, 2003), 488 pages.
5. Hal are the initials of the author. Hal is also the name of the supercomputer in the flick Odyssey 2001.