CHAPTER 20

Impact of Technology on Learning and Scholarship and the New Learning Paradigm[1]

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INTRODUCTION

Recently I took on the challenge of teaching a course to Undergraduate students at Singapore Management University. It had been more than 20 years since I had taught any Undergraduates, having spent most of my career at Graduate Business Schools. I did it partially because many of my younger colleagues had told me that teaching had changed tremendously. Deep down I may have felt that I was perhaps a little out of touch with what happened inside and, as I would soon discover, outside our classrooms.

I was indeed intrigued by the experience. When I entered the classroom for my first class, I was confronted with a forest of laptops, and most students had as well a smartphone if not a tablet computer on the side. The class I taught was very interactive, and I was often surprised how students would pull up additional material through the internet to complement, if not correct, what I had shared. They had done their homework and watched YouTube videos about some of the cast in the cases I taught. And often they had updated the stories discussed in the case. I also noticed that many of them had more than one website open, and were combining the discussion, my slides and other

1. This paper has benefited significantly from the comments of Sriven Naidu and Tan Gan Hup. I wish to thank them. But the responsibility for the positions taken in this paper is mine.

materials with an occasional glance at Facebook, Weibo or another social network site. The students admitted that there was a parallel class discussion session going on over these networks about what was happening in class. I realized quickly that even in a very interactive class I never had their full attention. But I also quickly learned that I could keep the conversations going before and after class over the same websites or our Learning Management System (LMS) and thus enrich the learning experience.

At about the same time the University went through a major review and revision of the Library, reducing drastically the number of printed books and journals, thereby also reducing the number of racks and making space for a 24/7 study and group discussion facility. We had set it up as an experiment with different types of furniture and functions, so as to see what students do with such facilities. It struck me that while students were often quietly studying in front of their laptop and with headphones deeply plugged into their ears, they also wanted to sit together, apparently studying together, or as one said, "hang out" with each other.

Technology in education is not alien to me. I have actively already participated in three waves of using technology to change the nature of higher education: the development of videos for individual learning in the early 1990s, the first interactive online programmes in the late 1990s, and blended tailor-made programmes for executives in the early 2000s. Frankly these previous waves had all somewhat mixed results. But I have to admit that what I lived through in the recent years is of a very different nature. I see the emergence of a radically different learning paradigm.

The impact of technology on learners entering university shouldn't be underestimated. Sophisticated Info-comm technology penetrates daily life at an accelerating rate. Students entering University today saw the first smartphone when they were 6 and may have been using an iPhone when they were 12. Our next wave of students will include many who used the iPhone from when they were 8. Those who are currently in primary school — well, iPhones, Facebook or Weibo, Twitter existed even before they were born.

Increasingly, each cohort of "digital natives" entering a university for a Bachelor's degree will expect that their learning experience will build upon the competencies and IT literacy they have grown up with. Such competencies will include the ability to acquire knowledge from the internet, to collaborate online synchronously and remotely, etc.

Many Universities scramble to adapt curricula to be more in step with rapidly changing expectations of employers. We may need to begin questioning more seriously how much more responsively Universities should monitor and adapt to the changing profile of the students they enrol.

Like many other Universities, we also see the growth of research about and anchored in Big Data. It seems to change the nature of the research paradigm.

Predictive Analytics and Social Technology have become the topic of the day in research methods. As many have argued, this may well change the way we perform empirical research, emphasizing much more a renewed inductive approach over the more accepted hypothesis-driven Popperian approach or model building.

These and other events have made me reflect on how technological evolution will have a lasting impact on learning and scholarship.

A FEW HELPFUL CONCEPTS

I found it helpful in my understanding of the role of technology to rely on four concepts.

The first one is Sociomateriality as proposed by Orlikowsky and Scott (2008). They make the distinction between three different research views of social and technical worlds. The first view is that humans and technology are assumed to be discrete, independent entities with inherent characteristics. The second assumes that humans and technology are interdependent systems that shape each other through on-going interaction. The third, the Sociomaterial View, is that humans and technology only exist through their temporally entanglement.

Simply put, the first view sees students and technology as independent. For example, a student does not change or act differently because of different types of classrooms. The second view implies that we recognize that technology interacts with students, and enables them to perform different activities. In this view, for example, online books or journals enable our students to consult literature independent from the place where they are, or it allows us to offer online classes which can be attended by students all over the world. But the basic experience of analysing the literature or attending a class leading to a degree does not change fundamentally.

The third view implies that through the entanglement of technology and humans, we actually become different beings. Many scholars who study the relationship between Men and Technology had observed this before. Suchman (2007) describes how engineers and designers working with Product Life Cycle Management Systems (including CAD-CAM) behave totally different than in earlier design environments, when they become immersed in a multiplicity of documents, conversations (on an international scale), virtual excursions to a project site, etc. MacKenzie and Millo (2003) noted in their analysis of the Black-Scholtes pricing model in options markets, that it was originally a mere theoretical formula, but that it enacted over time a world of computer algorithms, professional skills and financial institutions in which the human actors became very different financial professionals. In the same way, we can argue that our students are actually different: they learn differently and act differently

because of their entanglement with new forms of information and communication technologies. The student who is always connected, who has access to an overload of information, who wants to express freely his or her opinion on blogs, who combines living in virtual and face-to-face networks is a different person than the one who went to lectures to take notes, who studied from printed textbooks and wrote letters. If we accept this hypothesis we need to look for *a different learning paradigm that optimizes the learning of this new student*.

The second theoretical concept that can help us is how management scholars have developed a new approach to service innovation. Barras (1986) suggested in his influential paper that, contrary to product innovation, service innovation follows a reverse product cycle. Service organizations adopt in first instance a technological platform to increase the efficiency of the service production and delivery, followed by the improvement of quality and effectiveness. Only in a third phase does the technology assist in generating wholly transformed or truly innovative services. This model was originally developed for financial and professional services, but we have shown that it can easily be applied to ICT based innovations (De Meyer *et al.*, 2001). Internet provided a technological platform on a network, where first we could share information and mails in a more efficient way, then we improved access to data and applications, and finally we created totally new services (as is illustrated by Amazon in the retail sector or Facebook in networking).

This reverse product cycle may well apply directly to what happens in the learning environment at our universities. The ICT platforms were first used to enhance efficiency e.g. by making class materials available online and by offering simple MOOCs. Later on we improved the quality of the learning environment by providing rich media information, taping lectures so that students could review the materials more easily, etc. Now we are in the phase where *truly disruptive and innovative approaches to create a new learning environment have become possible*.

A third concept that may help us is that of the Service-Dominant logic (Vargo & Lusch, 2008). This approach describes a service not as some form of an intangible product, but as "a process of using one's resources (e.g. knowledge) for someone's (self or other) benefit as compared to the more traditional conceptualization of services […] as a unit of output (i.e. an intangible product)" (Barrett *et al.*, 2015). Learning at our institutions appears clearly to be such a process. Learning as an output of what we provide at Universities is not a discrete intangible product, but a continuing process. We need to provide an answer to how we redesign this process in the current context, where *Information technology will no doubt play a central role in the formation and functioning of our learning ecosystems* and thus in learning innovation.

The fourth concept is of a different nature. It is about the role that Big Data may play in influencing our research and research methods (Gandomi

& Haider, 2015). Big Data, characterized by the three Vs of Volume, Variety and Velocity, is expected to have a still uncertain impact on what and how we research through prospective analytics. Prospective analytics can be applied to many fields from predicting the failure of jet engines based on the stream of data from several thousand sensors, to predicting customers' next moves based on what they buy, when they buy, and even what they may say on social media. It is to a large extent based on pattern recognition and discovery of more or less complex relationships. This is very different from our traditional research methods. As Martin Rees, the former President of the Royal Society in the U.K., has said: "Big Data will allow us to mine and mash our way to unexpected discoveries and insights. It may allow us to ask new questions, one that we couldn't have asked when science depended on the work of a few people in a single lab working in a limited area of knowledge with just a few gigabytes of processing power" (Pisani, 2010). *The days of hypothesis-driven scientific endeavour may be behind us. Now it is all about pattern and relation recognition.*

WHERE WILL THIS LEAD US?

In the following sections I want to speculate on what these four concepts entail for teaching (or learning), research and the business model for the Universities.

Impact on education

Let me be clear: I will not dwell any more on the effects of technology on the efficiency or the quality enhancement of our delivery systems. Many of us have implemented online LMS, online course materials, and we may have experimented with MOOCs or other forms of distant learning. Keeping in mind that we are searching for an innovative and disruptive learning paradigm, I would like to propose five additional changes:

We are moving *from a teaching paradigm towards a student-centered learning paradigm*. I was raised in an era where Universities had a few quasi-monopolies: University faculty were the source of knowledge, University Libraries had a quasi-monopoly on information. Universities were bound by their physical location and it was our task as educators to provide knowledge (and in some cases even bits of wisdom) to the students. The only monopoly we may still have today is the right to grant degrees. But all else is widespread and competitive: geographical location and distances have become almost irrelevant, knowledge is accessible (and often relatively free) across geographical and organizational boundaries, and in many cases the educator does not know much more than what the students have easy access to. Our role as educators

evolves towards that of a guide and a facilitator: a guide to help students make the difference between the good, the bad and the ugly information; a facilitator to help make sense out of the overload of information available at our fingertips. As a consequence the initiative for designing a curriculum may well shift a bit from the academic supplier to the student-user. Some have speculated that we may evolve towards a world where the student attends courses in different institutions, sometimes online, and assembles in that way the degree (U.S. Department of Education, 2006). When I see how clever some of our students are in combining our classes with some of the local and international exchange programs and independent study units, I am convinced that this is less farfetched that we might think.

The new learning paradigm will be no doubt be more *experience based*. Project based learning as a subcategory of experience based learning is not new. It was a hallmark of a lot of engineering education. The simple idea to start from a real as opposed to a stylized problem, and have the students learn from the experience they build up in solving these problems will get more and more application in other disciplines.

Related to this is the concept of the *flipped classroom* (*The Economist*, 2011) where we let the student learn the conceptual frameworks outside the classroom, thus freeing up time in the classroom to apply the concepts by solving problems, debating applications, etc. This may not sound revolutionary to those of us who have been teaching by the case study method for example. The change is no doubt in the richness of what can be done outside the classroom through rich media and social networking. As I mentioned in my introduction, it struck me as a veteran case teacher how much more I could engage with students about the class materials before and after class.

"Going to the classroom" will be less and less identified with spending time in a well-defined and constrained physical location. *The classroom has become virtual and may exist everywhere and at all times of the day*. Students collaborate and dialogue over networks during class hours and outside these specific times. They work with colleagues next to them in the Library (though still over internet), or with friends and colleagues elsewhere in the world. Geographical and organizational boundaries have less and less meaning and importance, and interaction will move much more from one-to-one (as in tutoring) or one to many (as in a lecture) to a many-to-many interaction (as in social networking).

Educators will have to spend much more effort and creativity on Learning Analytics (Greller & Drachsler, 2012). I don't want to go in a debate on the precise definition of Learning Analytics but generally it is about the use of learner data and analytics to predict and to advise on students' learning. While we may always have had some data and support systems to advise the students, it is imperative that in an environment where the responsibility for

the design of the learning trajectory shifts from the educator to the student, we provide much more information to guide the student.

Impact on Research

The impact of technology on research may come somewhat slower than on education. Students' turnover is higher than that of scientists and researchers: we have a vast installed base of disciplinary research anchored in classical hypotheses based paradigm, which may slow down the shifts. But I predict four changes:

a) One of these is the *radical internationalization* of research. Future research will be networked. This is a continuation of what already exists, but the tools for communication and for research support will enhance considerably the productivity of internationally networked research. Research, design and engineering support systems, e.g. specialized social networks, Product Lifecycle Management Systems for design, cheap video communication systems or retrieval and document management systems have made huge improvements and have enabled a new generation of international research networks.
b) As mentioned before, Big Data and Predictive Analytics will make non-hypothesis based research more acceptable. Both the way we ask questions and how we solve them will be adjusted. There are huge opportunities in this, because we can study phenomena that used to be out of our reach. But there are also some risks. Pattern recognition does rarely address causality and may thus be effective in prediction, without really being able to explain why. "Fishing", a more colloquial word for data mining, is not yet accepted or acceptable by scientists. But it may only be a real problem when the datasets are too small or the sampling has been too weak to support any insights. I can foresee a future "galactic" battle between the galaxies of Big Data and Data Science and the traditional scientific approach. And the battlefield will be partially in our Universities.
c) A third trend is the emergence of what some call Social Technology, or the application of Data Science and Big Data to social problems. In social sciences we were often limited by small sample sizes and costly and difficult access to subjects for experiments. How many psychological and sociological experiments have been carried out with undergraduate students at top U.S. universities? Or how many healthcare studies were limited to small samples of a few hundred subjects. Apps on mobile devices have made it possible to transform healthcare studies to the study of tens of thousands of subjects easily (Apple, 2015). I have no doubt about the rigour with which these older

studies were carried out, but one cannot but think that the samples were socially and culturally biased and generalization was therefore difficult. The rapid diffusion of sensors to capture data on all aspects of life and society, and the creation of vast, varied and fast evolving databases of user behaviour in social networks, online retailing, etc. open up tremendous perspectives for rigorous, relevant and truly revealing social sciences research. This development is not without risks. There are concerns about security, privacy and ownership of personal data. Frankly speaking I don't think that University administrators will be able to stop researchers from jumping enthusiastically on these new opportunities. But University administrators will need to overcome the issues of cybersecurity, government legislation e.g. the one on offshore information usage or data protection, and create a common international consensus on working guidelines for Big Data researchers.

d) Technology may also create more potential for interdisciplinary research on pressing societal issues. Let me take an example. Many countries are confronted with the challenges and opportunities created by an ageing population. Understanding how we can get productive and happy ageing requires research in areas as diverse as medicine, mechanical engineering, finance and economics, sociology, ethics, sensors, data processing, and many more. We also know that grasping the real opportunities of an ageing population will require the complex interaction between these different disciplines. Technology may help us to bridge these differences.

As I mentioned, I am not sure whether we as university administrators will have a big influence on these evolutions. Creative researchers and scientists will always be a step ahead of us. But we may want to think about the frameworks and the context in which these evolutions can be optimized, and performed within boundaries accepted by the professions and the society.

Impact on our 'business model'

We know that what is described above will require us to make significant investments in technology. And the costs of technology seem to be escalating. While the administrators want to keep the cost of technology down, we also know that we don't want yesterday's technology and that our students and researchers require us to constantly upgrade and improve the technology systems. We need to recognize that the technology bill will not decrease. Thus University administrators will be forced to think where else they can reduce costs to keep investing in technology.

But it is not that cost challenge that I want to focus on. There are three other issues that will require all of our attention as University administrators:

a) *The emergence of new competition*: most of our research universities are built on the combination of the Von Humboldt model of a research institution of early 19th-century Germany combined with the teaching methods developed in Oxbridge, and refined in the top U.S. universities. It was and is a strong and performing model that was partially based on a monopoly of granting degrees (either granted by the Governments or in very few cases based on the sheer exclusivity and quality of the tuition). We know from other industries that disruptive innovations based on technology pose a risk for the incumbents, in particular when and if a university degree becomes less valued, or can be offered through means other than a government decree. Private universities pop up all over the world, and fill voids left by the traditional universities. Alternative pathways to success in the professional world are pondered upon by governments, in particular on the basis of the OECD report on Continuing Education (OECD, 2014). And actors such as Coursera offer modules by very distinguished faculty from very recognizable institutions, therefore making it difficult for others to charge premium prices for sharing knowledge. I have little doubt that the top among the traditional universities will survive, but I do fear that many of the other players in the academic sector will be forced to act more and more as a commercial operator and will have to adjust some of the values of the University as a social good.
b) *Pricing*: Big Data and Data Analytics will allow us to radically redesign and customize courses for delivery either face to face or electronically. This may also implies significant economies in paper wastage, reduced teaching redundancy, lower administrative costs, and, as I mentioned, to some extent a shift of the design of the curriculum from the faculty to the students. Will we pass on these savings to the students? As the OECD (2014) suggests: "It is possible that there may be a growing prevalence in universities adopting hybrid pricing structures, using the fee premium from commercially viable sources as funding to provide education access for the underprivileged."
c) *Rise in expectations:* As technology has enhanced the possibilities for learning and scholarship by research universities, we may expect our stakeholders' expectations to rise. Public funders of education may soon expect greater accountability on the return and the impact of their investments, and likely in more tangible and immediate terms. In a not very distant future, research funding agencies may expect the use of technology to track the diffusion of knowledge created through

grant-funded research. Governments may require Big Data efforts to monitor the social and economic impact of research-informed policy interventions.

An observation common to all of these trends is that there is a significant trend towards the commercialization of Higher Education and the University. We know that this is not without risk. Derrick Bok (2004) has argued that the commercialization of Universities may well jeopardize our fundamental mission by accepting more and more compromises of basic academic values. There are indeed significant risks when such commercialization would lead to more secrecy in corporate-funded research, or when customer orientation towards students and parents would lead to compromises in the rigour of the education.

SINGAPORE MANAGEMENT UNIVERSITY AS A SHORT CASE STUDY

What do we do at SMU with all these opportunities and ideas? (SMU, 2015a) We experiment in our way and we are very happy to share the results of these experiments with our peers.

While we have decided not to engage in the production of MOOCs, partially because of lack of resources, we have experimented successfully with the use of technology in learning. All of our course materials and course management can be online, though it is still a choice for our faculty how much of these opportunities they want to us. We are in the process of having all faculty go through a training to be acquainted with the process of online teaching. Furthermore we have experimented in both undergraduate and graduate programmes with a variety of technologies.

Let me give you a few examples. We organize a series of blended courses, i.e. where part of the teaching and learning happens online, but alternating with face-to-face sessions. Some of those experiments are purely internal. In other cases e.g. the blended IE-SMU MBA program, we are also happy to learn from our peers. We also have global courses where students from SMU and USC recently participated in classes from opposite ends of the world with the help of technology before they met on each other's campuses.

The experiment in our Library with different learning environments has been complemented with the development of a new three-storey facility called SMU Labs. There we have a variety of flexible project rooms, discussion areas, huddle rooms, a one-button presentation room, an active learning classroom and a white room for creative thinking. It is also a space where we are developing SMU-X standing for eXperimentation, eXploring, the X-factor or even the unknown (SMU, 2015b). SMU-X is a combination of

experiential courses which are supplemented by a collaborative, co-working environment. And it is an informal/casual 24h space for student centre learning and to blur the lines of classroom and out-of-class space (to support your impact to education para), tapping into the richness of out of class experience and learning through social networking.

In Analytics and Big Data SMU's School of Information Systems has a wide range of research programmes (SMU, 2015c), some of them in collaboration with Carnegie Mellon University. The portfolio of these research programs originated in more technical research, but gradually the users of these technical capabilities in Management and Marketing, Sociology or Psychology are getting involved. Examples of such research are the high frequency internet surveys (aided by student surveyors with tablets) carried out by the Centre for Research on the Economics of Ageing (CREA) (SMU, 2015d)

CONCLUSION

I have argued that the current opportunities offered by technology may lead to a fundamental change in our learning and research paradigms. There have been waves of technology impacting higher education before. But in line with the concept of socio-materialism and the disruptive innovations that have become possible on a stabilizing ICT platform, we may have to redefine the complex system that a present day University represents.

Such a redefinition comes with risks and problems. I referred to issues of rigour in education and research, privacy protection, accountability or the threat of the pure commercialization of the University sector.

This begs the question of what we might aspire to achieve with these new emerging research and learning paradigms. Should they embrace a diversity of elites — and define those who fully embrace diversity as a new elite? In the past, research universities educated the elite of society and prepared its leaders, scientists and future statesmen to fulfil larger responsibilities. Things are different today. Participation in higher education has been "democratized" as access has increased across the world. Most governments invest significantly in research to remain competitive as knowledge-based economies. As a result, research universities today educate a significant proportion of society. Diversity on campus has thus increased on many dimensions — ethnicity, nationality, gender, socio-economic status, previous scholastic performance — and unexplored scholastic potential. Social interactions will become an increasingly important design component of programmes if on-campus education is to remain distinctive and valuable.

Perhaps a key opportunity for the new research and learning paradigms is embracing and harnessing such diversity, and allowing students to learn how they can contribute not just as individuals, but also as bridges. Bridges

between cultures, disciplines, between theory and application, between stakeholders with different interests — yet keenly aware that they share the same future. University education should remain an important way to transform society. It is at risk of yielding to pressures to merely transform young adults to play a role in the workforce.

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