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The future of education in a wired world

Tom P. Abeles

Universities were founded around 1100 and retained their basic mission until mid 17th century when forward-looking research started to enter the institutions. In the mid 19th century when the US land grant institutions were created, universities added new areas of practical or applied research and community involvement. With global access to the Internet, a major moment in the 21st century is occurring that disrupts the very foundations of the academy and academics as independent institutions in all aspects, teaching, research and function in the community at large. No institution will remain unchanged; not all institutions will survive. This article discusses some of the changes occurring and the implications for the future of post-secondary education, globally.

The future of knowledge

In today's world, basic knowledge or what one might label „textbook” knowledge is fungible, transferable across geopolitical boundaries and asymptotically approaching zero in cost for accessibility. Thus, most of this material that has been carefully hoarded behind the walls of academic cloisters becomes readily available across the planet depending on the ability to access the Internet or other system for transmitting information. This holds at all levels of intellectual maturity, from K to Gray.

Max Boisot, in his seminal volume, *Knowledge Assets*¹, describes what he calls a Social Learning Cycle, or a model of how knowledge moves through the social structure. Boisot's ideas are represented by a three dimensional model called „I-Space” where he shows how diffused or common knowledge becomes selectively absorbed, applied in products and services, becomes accepted/diffused and then recycled. Boisot also defines a production function that describes how knowledge has evolved from being locked into an object in primitive societies to becoming more abstract in the form of data as societies transition to industrial systems and beyond.

David Snowden's ASHEN model² for knowledge acquisition by individuals embodies this thinking and becomes important when looking at the role of education. ASHEN (artifacts, skills, heuristics, experience, natural talent) describes the ease of knowledge acquisition where artifacts are objects embodying knowledge and the other elements define how effectively that knowledge can be absorbed, articulated or applied.

With the rapid and continuous rise and increasing sophistication of digital technology, the function of today's academic and the academy, itself, has changed. Traditionally, during part of Boisot's learning cycle, it is the educator who either provides or directs individuals in their gaining of knowledge. Gradually, individuals should be learning to also critically investigate the larger world and start to define direction, opportunities and needs to fill an armamentarium with tools to participate in society.

Both the critical ability and the motivation to seek and act on this knowledge are now seen as an essential skill starting in primary schools. The current and historic path has been for a student to defer to the master at the „front of the room”. The critical skill is the ability to balance self-direction with the understanding of outside expertise. It is this skill that manifests itself in creative leadership and in work with others to accomplish the tasks at hand.

The development of individual competencies in education is expanding. The idea of allowing students to advance based on demonstration of knowledge mastery rather than having completed a set amount of time in classes is gaining purchase along with a more balanced relationship between students and faculty.

As these competency-based skills are being integrated into primary and secondary education, individuals are acquiring capabilities that are often seen only after entrance into the workforce where there is a need to demonstrate skills in practice. Competency based education at all levels is expanding and represents one of the major disruptive forces in education

¹ M. Boisot, *Knowledge Assets*, Oxford University Press, 1998.

² D. Snowden, *The ASHEN model: an enabler of action*, 2004, http://cognitive-edge.com/uploads/articles/7_Organic_KM_1_of_3_ASHEN.pdf, [22.06.2015].

in all areas from economics and management of the institutions to the very core of learning.

There has been and still continues to be a disruptive transition from secondary institutions to a variety of post-secondary institutions where the idea of self-direction arrives abruptly. Few institutions and their academics have yet to effectively integrate their content specialties with the type of skills to participate with the students in this changing and increasingly uncertain world. In fact, the academics, themselves, are finding this dynamically evolving change disorienting.

For example, in the United States, there are secondary schools that have programs with such names as „Early College”, „College in the Schools”, „Advanced Placement” and similar labels for programs that provide opportunities for students to arrive at the end of a secondary school program with significant „credit” to be admitted to a university with advanced standing. There are independent courses offered by third parties that are of sufficient caliber to be accepted for academic credit. And competency-based experiences basically allow students to qualify based on knowledge mastery instead of the traditional time-in-class credit hour measures.

The disruptive barrier between secondary and post-secondary is dissolving. One then needs to ask as to why, from a cognitive skills mastery perspective, should any barriers to knowledge advancement exist. What have not been addressed are the soft-skills that may, in part, be age- and in part culture-related. Faculty in traditional PreK-to-12 institutions scramble to deal with both cognitive and soft-skills. They have had programs to build their capabilities. Faculty in the post-secondary institutions, essentially, have not had the benefit of this type of support.

Additionally, in many post-secondary institutions, the historical reward structures for tenure-track faculty are not oriented to functioning in this complex system of cognitive and soft skills issues. In fact, most post-secondary institutions, today, have become oriented to reward the creation of new knowledge within narrow disciplinary boundaries as the foundation for advancement.

What makes this critical and disruptive is that the recent advancement in „Machine Learning” (Deep Learning or Artificial Intelligence) has the emergent capability to change much in how fundamental research is done; both the amount and quality can transcend human capabilities³. And now, individuals can gain knowledge and competencies without the conventional academic institutional process. It is changing the nature of education- the relationship and roles between what has been defined as „student” and „faculty”. What makes this important is that it is carv-

ing out new roles of faculty in traditional disciplines from the hard sciences to the humanities.

The change is coming from two directions. In post-secondary institutions, the emergent Machine Learning represents a rapidly approaching future while numerous contemporary factors from the formation of interdisciplinary and cross-institutional research teams coupled with changing economics of universities is forcing academics to have to respond to both cognitive and soft-skills.

In the primary and secondary schools, students are being given opportunities to exercise their own „executive” skills or skills where they work with rather than are dominated by faculty created programs of knowledge acquisition. Thus, across education the old cliché of the role of the faculty as a „guide” rather than the „sage on the stage” is becoming manifest.

This transition, aided by intelligent technology is manifest in a recent book, written by a cardiologist, *The Patient Will See You Now*⁴. Basically, it points out that „smart phones” are, or will be shortly, equipped with sensors and software to allow individuals to be able to not only send critical information into medical centers but, for much of an individual's needs, be able to provide the „patient” with the same critical information to be able to intelligently diagnose his/her own medical status and receive suggestion of appropriate actions. The advances in artificial intelligence using a variety of algorithms are able create machines that can transcend the capabilities of human sensory systems and interpret information that required years of education for both individuals in professional practice and even in fundamental research. These devices, connected to the Internet are now packaged as, essentially, hand-held systems⁵. Such capabilities have been well foregrounded in Neal Stephenson's prescient novel, *The Diamond Age*⁶.

Tackling the cognitive skills problem

In the past, knowledge resided in the heads of scholars or it was housed in academic cloisters. As more individuals sought access, the demand was met by increasing the number of universities and the faculty therein. The arrival of the Internet has essentially created both an expedient vehicle to increase the assembly of such knowledge and, more importantly, has built a number of paths that allow the individual to selectively choose to either bypass the control points, the Ivory Tower, or to selectively access the traditional institutions for both acquisition and certification. It is the certification function that has provided the force driving knowledge seekers into the universities, because the certification provides the key to entering the productive economy.

³ E. Brynjolfsson, A. McAfee, *The Second Machine Age*, WW Norton & Co, Ltd, 2014.

⁴ E. Topol, *The Patient Will See You Now*, Basic Books, 2015.

⁵ Cf. Jeremy Howard's Ted Talk, <http://tinyurl.com/ojbtrae>, [22.06.2015].

⁶ S. Neal, *The Diamond Age*, Spectra, 2000.

Competency based education (CBE) starts to change the relationship between the learner and The Academy as the sole gateway to certification of capability. This is becoming increasingly important as many individuals are taking an entrepreneurial route into the world of work. Also, many entities that need skilled workers are finding that, currently, of those with academic certification, many do not have either the needed requirements or the quality that an institutional certification implies.

What has yet to be fully considered is that the world is past the 2008 economic „meltdown” and there are clear indicators that the recovery will not return to a conventional growth model. In fact, the idea of „continuous and increasing” growth rather than a „balanced” or zero growth model in a global society is under serious consideration. Some governments have adopted alternatives to GDP or gross domestic product as a meaningful measure on which to base policy.

As Kevin Fleming’s prescient video, *Success in the New Economy*⁷, clearly points out, following the standard path through the university will not guarantee the previous claims regarding income and job security going forward. In fact, Fleming’s model points out that the future work force will fall into the ratio of 1:2:7 where the market will need one masters and above prepared person for every 2 persons with a bachelors degree and 7 individuals with experience, On the Job Training, apprenticeships or similarly skills prepared individuals. Since there is an increasing emphasis on service employment, this caveat stretches across all the liberal arts/sciences disciplines.

This starts to call in question the almost fundamental belief that a 4-year university degree is both a path to gainful employment and a rite of passage into society. The „Arab Spring” which arose in 2010, in part, because of the lack of jobs is an iconic moment that has rippled through the global economy where, except in selective fields, income and employment in general for degreed persons has not yielded the expected return on investment.

What is even more interesting is that as the recovery has grown and profits return, workers have not seen a proportional gain. Moreover, while employers claim that they cannot find qualified graduates, in many cases, the reality is that wages have not risen sufficiently to attract such individuals. In defense of the corporate world, developed or under resourced, it has been demonstrated that a significant number of individuals who have received 4 year degrees have proven to be deficient in basic literacy and numeracy as well as the soft skills needed in an increasingly service economy. While the issue of skills deficiencies have been documented in developed economies, the issue is significantly greater in under resourced countries

where many students enter under prepared and standards of academic performance in the post-secondary institutions have been adjusted accordingly.

Again, with the Internet and the growing bypasses around institutionally created bottlenecks, a number of interesting paths are materializing. The most recognizable are the MOOCs (Massive Open Online Courses) that are mostly provided by highly recognized faculty, mostly from medallion institutions in developed countries. These are usually free with small additional costs for materials and certificates of completion. These and a host of low cost on-line courses from vetted individuals and institutions are offered in a „competency” format, allowing students to proceed at their own pace to demonstrate mastery. These are often accepted in traditional institutions as meeting their requirements of credit to a degree.

The quality of the offerings and the ability to advanced based on competencies go a significant distance to raise and validate standards of achievement. Since the courses are essentially anonymous and self-paced and often accompanied by the ability to obtain help from the institution or others in the program, it provides alternative paths to raise quality. What it does for weaker institutions is to challenge their very existence. And, there are parties who believe that many of these will not survive the dynamic and changing environment.

Indicators of a path forward

When there is a blockage in the flow of materials, be it for vehicles of commerce on highways, water flow in the environment, or even blood flow in humans, traffic finds a bypass, either an intentionally created arterial bypass around an urban environment, an alternative in other systems or a rupture of the flow allowing the fluid to seek its own paths. Globally, this is what is happening in education from pre-kindergarten to post-secondary institutions through PhDs and life-long learning programs.

In the post-secondary arena, Africa represents a significant lens into the emerging conflict of education development. The various countries are all struggling to raise the standards of their programs from undergraduate through research qualified PhDs. While they work on this at the country level, there is increasing realization that they are unable to expend the capital to raise these institutions and their graduates to international standards in all fields of intellectual endeavor. This is true even if they had ample resources and no other needs of equal or greater priority for the funds.

The currently preferred alternative for the countries is the development of continent-wide institutions such as the African Virtual University⁸ and the

⁷ *Success in the New Economy*, <https://vimeo.com/67277269>, [22.06.2015].

⁸ African Virtual University, <http://www.avu.org>, [22.06.2015].

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multi-campus institutions with focused programs, such as the Pan-African University⁹. This approach reflects paths being taken by academic institutions globally. Of particular interest is the creation of Kepler University¹⁰ in Rwanda, which is modeled on several competency-based programs in the US, coupled with the extensive use of MOOCs from globally recognized medallion-class universities

A conference volume for a continent-wide meeting in 2015, *Knowledge Production and Contradictory Functions in African Higher Education*¹¹ tackles much of the common concerns based on current thinking. It is interesting to note that while much of the thinking reflects an awareness of the past and the emerging transitions in the present, there is still the sensibility that the future will be different but not transformative in practice.

Thus there is visible the development of both the conventional wisdom of what an academic institution should be, the model grown from the first universities in the 1100's to the emergent collaborative, globally developing, institutions. Regardless of the model, there is an underlying sensibility for Africa that these solutions should be „African”.

What some countries realize is that, as suggested above, education is global. This requires not only collaborative sharing of both education transfer, but also research between parties in Africa and internationally. The developed countries understand that experience and practice as well as physical resources are too costly to be duplicated in both developed and, particularly, under resourced countries whether it is in physical facilities or manifest in the talents of faculty both in content or cognitive skills or in effectively managing complex and, often, contentious, academic institutions.

What makes the African evolution of importance is that it makes visible what has been suggested for many academic institutions in the developed countries, the start of collapse or severely attenuated functions of many of the fiscally weaker institutions whether public or private (for or not-for profits, both). The increase in global broadband Internet has resulted in the increasing number of institutions and entities that offer well-developed materials provided by world recognized thought leaders on subjects ranging from the humanities to mathematics and advanced materials in the science/technology area. The use of these can be for individuals, from self-directed knowledge acquisition to blended learning programs in post-secondary

institutions to recognized programs for competency validation for students.

Some of these are stand-alone programs such as Coursera¹². Others such as EdCast¹³ provide a more comprehensive support matrix from discussion spaces to links with specific universities offering their programs as open access. Programs such as Straighterline¹⁴ offer “courses” that current universities can accept as transfer credit. The global nature of these and other programs manifest the introductory idea that knowledge is fungible, decreasing in cost and accessible/transferable across geo/political boundaries. Africa is the global lens through which this transformation can be observed from an institution, country, region or continental perspective.

Implications

The Survival of Traditional Campuses is Questionable. Kevin Carey, in his recent book, *The End of College*¹⁵ re-affirms, in an Internet connected world and with the rise of machine intelligence (AI), that basic knowledge is fungible, transferable across geo/political boundaries and is available at low or no cost to end users. With the exception of African universities¹⁶ and many other institutions in under-resourced countries, many of the smaller and financially weak institutions will close. There will be some exceptions in the case where physical facilities will be needed but that will radically reshape these institutions.

The Need for Expanding the Number of Research Faculty will Diminish. With the exception of institutions in under resourced countries where advanced degree faculty of high quality will be needed for regional specific research, most advanced faculty will be needed as was true when the first universities were created, as teaching faculty for blended learning experiences or as support to major programs delivered globally by a host of select universities, not limited to the developed country campuses. Research will be collaborative and interdisciplinary where interdisciplinary teams will cut across the science/technology faculty and both the humanities and social sciences. A side impact will be the increase in quality but decrease in quantity of academic research publications with which the scholarly journal industry will have to deal.

Competency will be the Measure of Student Performance. This will be true from K-to-Gray. This will be validated by a number of different means from demonstrations from on the job training to internships and measures

⁹ Pan-African University, http://en.wikipedia.org/wiki/Pan-African_University, [22.06.2015].

¹⁰ Kepler Kigali, <http://kepler.org>, [22.06.2015].

¹¹ N. Cloete, et al., *Knowledge Production and Contradictory Functions in African Higher Education*, Africa Minds, South Africa 2015.

¹² Coursera, <https://www.coursera.org/>, [22.06.2015].

¹³ Edcast, www.edcast.com/, [22.06.2015].

¹⁴ StraighterLine, www.straighterline.com/, [22.06.2015].

¹⁵ K. Carey, *End of College*, Riverhead Books, 2015.

¹⁶ N. Cloete, et al., op.cit.

of both cognitive and soft-skills. Some of these will be through awards from traditional institutions and others through third parties. Students will advance based on mastery rather than traditional seat-time such as the „credit-hour”. Thus, age-defined cohorts and annual progress will be significantly diminished. More certification paths such as Universitas 21¹⁷ where degrees are validated by a multi-university endorsement will become prevalent rather than a diploma from a single institution. The current problems of individuals receiving diplomas but not being competent in areas represented¹⁸ will gradually disappear.

The exact forms and timing for these to manifest is not certain. What is clear is that, as the references and websites show, these elements are already present but not fully articulated. While these implications are broad and disruptive in their nature, it needs to be clear that what is happening is a rise in new forms of educational institutions and experiences. The current system will not go extinct but rather will be transformed as the new evolves. This is similar

to what happened to the US automotive industry when the newer alternatives from Japan challenged conventional wisdom.

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¹⁷ Universitas 21, <http://www.universitas21.com/>, [22.06.2015].

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