

Disruptive Pedagogies and Technologies in Universities

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ABSTRACT

This paper is a reaction to the increasing high cost of higher education and the resulting inaccessibility for the millions of potential learners now seeking opportunities for quality higher education opportunities. The paper examines the cost centers associated with campus-based and online education systems and then suggests that disaggregation may prove to be a cost-effective way to reduce tuition payments, while maintaining quality. The paper suggests that discount service models, now available to consumers in many industries may also be attractive in new models of higher education. The paper also briefly looks at the Open Educational Resources University initiative, a pilot, collaborative project attempting to test some of these innovations in a consortium of high quality, accredited public universities. Finally, we note both the disruptive characteristics of this model and commiserate opportunities for innovative providers of higher education.

Keywords

Open educational resources, Disruptive technologies, Online courses, Disaggregation

Introduction

In recent years, the emergence of low-cost, no frills, alternatives to many of the major service, transportation and manufacturing industries has had a major impact on different industries. No frills “economy cars” became available as early as the 1950s (Vance, 2008). No frills supermarkets and supermarket products and no frills holidays have been with us for some time. More recently we have even seen the growth of no frills prisons (Finn, 1996). One of the most well-known disaggregations has been in the airline industry, with the establishment of low cost carriers competing with established airlines. Significantly, there is also a major trend for established companies themselves to set up no frills alternatives, so as to remain competitive and retain market share across both traditional and no frills markets. Alternative lower cost services have also emerged in banking, travel agencies, accommodations, mobile telephony, stock brokering, and many others. Education has been relatively immune from such disruptive technologies perhaps because of the high cost of entrance (building campuses), the support and loyalty of alumni, government funders and the conservatism and anti-commercial culture of many academics and academic leaders (Christensen & Eyring, 2011).

The existing full-service higher education model is expensive and continues to become more so. Tuition costs for students and government subsidies to higher education institutions have continually increased above the rate of inflation in most western countries. For example, in the USA, between 1981 and 2011 the increase in inflation for all goods and services totaled 115% while increase in tuition costs during that time was 498% (Wadsworth, 2011). This increasing tuition cost has not been ignored by private sector entrepreneurs - as evidenced by the rapid growth of many for-profit postsecondary companies - notably the Apollo Group that owns the University of Phoenix, the Capella group and many others. Response, to these entrants into the postsecondary sector from traditional public and non-profit providers has normally taken the form of censure, complaint to public funders and derision of the product (Complaints Board, 2011). Nonetheless students, acting as consumers, continue to subscribe to their services.

In this paper we argue that some public and nonprofit institutions would be well advised to follow the lead of many other main stream service providers and create or partner together to develop and offer ‘low cost or no frills services’. These providers can benefit from the shared branding and selective service provision, while serving to maintain market share, gain economies of scale on differentiated services, reduce costs to students and at the same time stimulate innovation in the traditional full-service side of the organization. The danger of course is that students will abandon the full-service offering and be attracted to the discount service, thus reducing even further the demand for, profitability and sustainability of the mainstream service. However, in other sectors the activity of low cost providers has served to induce innovation but rarely to kill off mainstream providers (for example the banking sector in many countries).

Unbundling of educational services

Provision of quality post-secondary educational services in general and especially those provided at a distance consists of a complicated set of service provision, with many complementary and sometimes integrated services. These include content development, and related instructional design services, student support services, distribution and sale of learning resources, provision of library services, support for full time research faculty and graduate students, direct instruction, tutorial support, registration services and sometimes social services such as networking opportunities or face-to-face social services. Many of these services are mirrored for on-campus students, but some, such as athletic services, social clubs, pubs and restaurants are not normally provided to online students - creating potential, but rarely passed on, cost savings to distance students. Typically, online provision is regarded as a revenue generator by campus-based institutions, created (in part) to generate surplus funds and thus subsidize full service campus operations. For example the Chronicle of Higher Education reported that online courses at the University of Southern New Hampshire posted a substantial profit margin in the 2011 fiscal year. The university plows this surplus into buildings, salaries, financial aid at the traditional campus, and online program improvements (Parry, 2011).

The multifaceted nature of the services and costs centers associated with this aggregation of function and service provide the context for the possibility of disaggregation and removal or outsourcing of selected component pieces of this complex education system. This unbundling could form the basis for the cost advantage of many online institutions.

In the next section we examine each of these services, showing existing and emergent services that could be unbundled, eliminated and/or outsourced to collaborative partnerships or to more effective private or public service providers. We are not arguing that there is as yet any single best solution for such unbundling, but rather that institutions should look both strategically and critically at all components of their development, delivery and accreditation systems and decide which should remain in-house and which are either not core business or which cannot be provided cost-effectively. We believe that such a thorough examination and re-engineering of higher education can result in cost savings for institutions, but more importantly could reduce the tuition cost barrier and thus increase access to quality educational opportunities.

Analysis of Higher Education Cost Centres

Research

We begin with the cost centre that is likely the most controversial, but also the one that has at least the second greatest (behind in some cases the cost of teaching) impact on learning cost - that of supporting research in the University. To many faculty, administrators and government funders, the most important function of the modern university and the defining feature that distinguishes the university from community colleges and other educational institutions is the production and dissemination of new knowledge by faculty through their research. While not denying or arguing against this important role, there can be little doubt that it is expensive and often encumbered with traditional rights and responsibilities of tenure, promotion, commercialization and mobility of faculty members. In the past two decades many universities have attempted to capitalize on the research endeavor and recover some of the costs of research through the establishment of commercialization services such as support for market analysis, securing of patents, promoting partnerships and providing incubator facilities. However, few universities have been successful at generating revenue from this commercialization. On the contrary, in many institutions, technology transfer offices have not even been cost recovery and have increased costs to university budgets (Chapple, Lockett, Siegel & Wright, 2005).

One of the most pervasive arguments for research propagated in the academy is the belief that good teaching is correlated with good researching. Or even the claim that unless one is doing active discipline research, one cannot be informed enough or competent to be a university teacher. There is little evidence to support this argument. In extensive meta-analyses of the relationship between research and teaching (Gibbs, 1995; Hattie & Marsh, 1996), each found that there was no or very little relationship between teaching and research excellence. Hattie and Marsh (1996) concluded that "the likelihood that research productivity actually benefits teaching is extremely small or that the two, for all practical purposes, are essentially unrelated. Productivity in research and scholarship does not seem to detract from being an effective teacher and vice versa" (p. 529).

This belief in the correlation of research and teaching productivity and excellence is now very pervasive among university faculty and administrations, yet it is not a factor that defined universities for most of their existence. The classical medieval Universities of Bologna, Paris, Oxford and Cambridge, were initially funded and controlled by students, who hired professors whom they believed had and were capable of sharing knowledge through their teaching. Later universities, were established to train professionals - notably Harvard - for training ministers of religion and Edinburgh for training medical doctors with little emphasis on faculty research. In later times, research was carried out mostly by gentlemen and amateur 'natural philosophers' who created a research system referred to by McNeely & Wolverton (2008) as the "Republic of Letters". It was not until the 19th century that Wilhelm von Humboldt established German universities with an explicit aim of generating new knowledge and thus the laboratory became a fixture of university infrastructure. Thus, it is mistaken to argue that research has always been a defining feature of university life. However, it must be said that research and the costs of supporting that research is currently a major focus and rationale for public, government and in some countries corporate support of the modern university.

Provision of the next generation of scholars

Every institution strives to maintain and reproduce itself. In the case of the university this involves the training of the 'next generation' of researchers and teachers. It is arguable how well the university trains its faculty at teaching, and there is tendency for professors to be unimaginative pedagogues who 'teach as they were taught' (Pocklington & Tupper, 2002). Nonetheless, if the university abdicated the training of replacement faculty (as is done by most of the private universities) there certainly will need to be alternative means created to undertake this important task. The failure of modern universities to disentangle teaching and research, especially as regards influence on both tenure and promotion, makes it very difficult for the University to induce, monitor and reward excellence in teaching and too often important personnel decisions are left to measurement of research productivity alone.

Provision of Course and teaching materials

The first generation of distance education institutions placed great emphasis on the creation of excellent teaching resources, in first print and later multi-media formats. This was in contrast (both in terms of time and money expended and resulting quality) to resources committed to classroom teaching. Typically classroom teachers, with the aid of a textbook or two and a set of informal lecture notes (now augmented by Powerpoint slides) produce individualized courseware, of variable quality and little or no editing or distribution. Both classroom and distance education courses are most often built upon the unbundled provision of a text book, created by commercial publishers and paid for, usually in addition to course fees, by the student.

The provision and widespread distribution of Open Educational Resources (OER) is beginning to disrupt both classroom and distance education models of courseware production and distribution. At present there are thousands of full post-secondary course modules available as OER online and tens of thousands of lesson modules in repositories such as the MIT-sponsored OCWC site, Rice University's Connexions, the Saylor Foundation, MERLOT, the Washington State Open Course Library, ARIADNE in Europe, and many others (Hysten, 2007). In addition, the US Department of Labor has made \$2 billion available over four years for training initiatives that must use an open access license (Department of Labor, 2011). Access to this rapidly growing font of usable learning materials has already increased the quantity and quality of informal learning. Seely (2011) notes that OER have had "the most visible impact" on individual learning however increasingly classes of students are using OER materials. The MIT OCW site alone has more than one million unique visitors a month. According to their statistics, 45% are self-learners and nearly 42% are students at other universities (MIT, 2011). These numbers do not count other OER sites or even MIT OCW mirror sites. Tufts University estimates that more than half of their visitors are independent learners (Lee, Albright, O'Leary, et al., 2008). As the quantity and quality of OER increases, they will become even more readily used by faculty. Already there is a large movement towards the use of open textbooks, primarily driven by their growing costs (US Government Accountability Office, 2005; Allen, 2010; Beshears, 2010).

Provision of Student Services

Most on campus and distance education institutions provide a host of services to their students. These include course and academic counseling that is designed to ensure students enroll in and succeed at courses that match their goals

and aptitudes. Testing and counseling services are designed to assist students in uncovering and dealing with personal or psychological challenges. Financial services are provided to help students budget and obtain loans, scholarships and bursaries to help them finance their education. The actual cost of these scholarships and bursaries is often covered by donations, but the solicitation for and administration of these scholarships is a cost component of student services. Finally, many campus-based organizations provide support for clubs, social and recreational activities. Recently online institutions are beginning to offer similar services using social networks (Anderson, 2004) - though we have yet to see virtual university football teams in the Rose Bowl!

Academic teaching and/or tutoring

The provision of direct teaching and establishment of 'teaching presence' (Garrison, Anderson, & Archer, 2001) is a major cost for universities and the one that has been shown to be associated with student satisfaction, learning outcomes and persistence (Martin & Mottet, 2010; Shaw, 2009). Most of us can recall the dramatic impact of at least one teacher in our time as a university student and mostly we remember the positive impacts. Although it has taken some time, there is a growing consensus amongst researchers, teachers and students that effective teaching presence can be established online (Gunter, 2007). The provision of interactive web conferencing, continuous monitoring and participation by teachers in asynchronous forums and the capacity for teachers to monitor student activity using learning analytics tools affords opportunity for very personal, attentive and interactive teaching presence. However, such high intensity teaching is expensive, time consuming for teachers and a major barrier to online teaching reported especially by new and inexperienced online teachers (Berge & Muilenburg, 2000; Shea, 2007).

University Administration

One of the largest complaints from academics is that university administration expenses are growing even faster than those associated directly with teaching and research. University hierarchies continue to grow with more deans, chairs, vice presidents, and a host of other roles (usually accompanied with support staff). This spending on administrative growth has outpaced the growth in expenditures for teaching since the 1930s (Bergmann, 1991). Unlike in other economic sectors, few universities have chosen (or as yet been forced by economic exigency) to flatten their organizations, merge, share services or otherwise drastically reduce administrative overhead.

Do we need and can we afford the full bundle?

In the remainder of this paper we suggest which of the services can be unbundled to create a model of university education provision that entails much lower costs for students – and/or potential for profit by private interests. We examine first the most expensive and most highly-valued service (to faculty at least) of the modern university -the discovery and dissemination of knowledge.

Quality research is expensive and there have been many good arguments demonstrating the positive economic and social benefit to the production and application of new knowledge. We are reluctant to suggest that research should be eliminated from the core function of the university, but do argue that it must be rationalized, strategic and focused. We are likely past the point where individual curiosity, unencumbered by social need, relevancy and cost efficiency can be the major driver of research funding in most universities. Recent developments using networks however promise considerable cost effectiveness in research that has not been realized in many disciplines (Nielsen, 2012). The interest in 'open science', that compels or induces researchers to make transparent and available their data and the processes by which they discover new knowledge, is the basis for increasing collaboration and reducing unnecessary competition (Mukherjee & Stern, 2009). Network connectivity and software also greatly enhances the capacity for creating new networks of researchers, sharing and archiving data, linking multidiscipline inquiry, discovery and filtering information and in other ways making research collaboration more effective and efficient.

The cost to institutional libraries for scholarly journals has resulted in a throttle on dissemination and grossly high profit margins enjoyed by commercial journal publishers (Monbiot, 2011). Open Access publishing of peer reviewed articles is growing in all disciplines and both universities and governments are taking efforts to at least encourage,

and sometimes to compel, faculty to disseminate their research results in ways that are accessible globally, at little or no cost to end users.

In 2003, one of the authors published a paper (Anderson, 2003), describing an interaction equivalency theory. By this we meant that interaction - long the most important, but costly component of any teaching system, from a student perspective, is generally of three types student-teacher, student-content and student-student (Moore, 1989). The first proposition of this theory is that "deep and meaningful formal learning is supported as long as one of the three forms of interaction (student-teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience." (Anderson, 2003). In traditional print based forms of distance education, the reduced or absent student-teacher and student-student interaction is compensated by very rich student-content interaction with sophisticated learning materials. Similarly intense one-to-one tutorials with a teacher, may be sufficient for high quality learning without much peer or content interaction. The quality of such intense student-teacher interaction is exemplified by a quote attributed to James Garfield in reference to a former president of his college "the ideal college is Mark Hopkins on one end of a log and a student on the other." Finally, intensely collaborative interaction among students as emphasized in many forms of problem-based and collaborative learning can afford much-reduced student-teacher and student-content interaction.

A clear way to reduce costs, without necessarily reducing quality then, is to reduce one or more of these three forms of interaction. The most popular form of interaction and also the most expensive for institutions, is student-teacher interaction. The broadcast media have been (and still are) used in this way to 'can' teacher lectures, discussions or experiments and thus convert these interactions into student-content formats. The reduced cost and ease of creating video and podcasts as evidenced on YouTube and especially educational channels and services such as the Khan Academy, have taken this conversion from the work of studio technicians into an end-user production technology. A second way to reduce the costs of student-teacher interaction is to substitute most or all student-faculty interaction by increasing the quality and frequency of student-student interaction. Network technologies, and especially social networks, immersive environments and low cost synchronous and asynchronous text, audio and video conferencing are now bringing the technical provision and mastery of these services down to the consumer/creator level. Two of the biggest challenges of this substitution relate to student attitudes toward and learning competence with student-student interaction.

However, these two solutions are not easily implemented. Students enrolled in formal education programs have come to expect student-teacher interaction and teacher feedback. In numerous studies student-teacher interaction has been rated by students as the most important and helpful form component of the instructional package (Swan, 2001, 2002). Especially in countries where authority, and seniority carry very high cultural value, it seems unthinkable to develop education courses or systems without the real - or virtual interaction and feedback from a teacher. By analogy, passengers on airlines had come to expect a variety of free movies to be enjoyed during a flight. However, recent policy changes from some discount airlines, that include charging for movies, show that the number of passengers willing to pay for such service is much lower, than those who watch or profess their value when they are provided free of charge.

In addition decades of research has shown the value of student-student collaborative learning in terms of increased learning in addition to the development of communication skills, improved attitudes towards formal learning and increased time on task and persistence (Gokhale, 1995; Johnson & Johnson, 1996). Yet many students and in particular many of those who are attracted to online learning, are not comfortable with or even interested in engaging in intense student-student interaction. A number of studies have identified issues of fear of freeloading, difficulty in project management and different expectations of effort and reward as creating challenges to effective group work (Swaray, 2011). Both of these factors need to be addressed if student-student interaction is to be used effectively.

The University Of the People - with the moniker the *World's First Tuition -Free Online University*, requires students to take a first course designed to improve their capacity to collaborate with, support and network effectively. There are also a number of promising web 2.0 tools with integrated versioning control, project management, notification and communications tools that are designed to enhance the technical support of student-student interaction. But perhaps most important is that students must be given a strong and compelling advantage (in this case likely drastically reduced cost) and compatible, trialable, simple and observable tools, techniques and systems (Rogers, 2003) to make a transition from student-teacher to student-student interaction.

Another means of reducing the high cost and allowing scalability is to increase student-content interaction. Dunlap, Sobel, & Sand (2007) argue that “student-to-content interaction is the key way in which students acquire new knowledge, skills, and abilities, changing students’ understanding or perspective.” p. 22. Thorpe and Godwin (2006) provide us with one investigation in which they conclude that it is not helpful to favor either interpersonal or content interactions, noting that there were positive and negative aspects to each. As evidenced by the strong emphasis on teaching people how to read, it is generally accepted that reading content is a reasonable and effective method for gaining knowledge, with or without the intervention of an instructor or mentor.

The MOOC (Massive Open Online Course) phenomenon was first implemented by George Siemens of Athabasca University and Stephen Downes of Canada’s National Research Council and recently followed by open courses from Stanford, and has led to spin off companies such as Udacity and Coursera. These are clear demonstrations of scalable, interactive, online courses in action. MOOCs take full advantage of the power of networks to provide learning opportunities to distributed learners using open content. MOOCs are usually highly automated allowing for asynchronous and synchronous interactions among and between learners, content and instructors (Mackness, Fai, Mak & Williams, 2010). While it is there is uncertainty as to credentialing and testing of MOOC students as discussed below, there is no doubt that high quality learning experiences can be made available at very low costs to most regions of the world.

The three ways overviewed above are means to reduce the costs of formal education. However, implementing these changes in interaction models does not ensure a quality educational experience. Since time-on-task often resulting from student motivation and time availability, has long been associated with success in both face to face (Stallings, 1980) and online teaching (Castle, 2010), it is likely to remain a key determinant of student success. Students must be actively involved for learning to occur. Thus, efforts and research should focus on ensuring student-student and student-content support that induces commitment and the motivation to learn.

Assessment and Credentialing

We are not suggesting that student-teacher interaction needs to be, or can be, totally eliminated. Rather, we should be examining means by which we can reduce the cost of this service. One of the most important functions often bundled with student-teacher interaction relates to assessment. Without assessment and demonstration of learning, no credible institute of higher education will offer credentials or otherwise certify the learners’ qualification to hold the degree or diploma awarded. Distance educators have for a long time been challenged with the difficulty of assessing students, whom they rarely or never meet face-to-face. The usual means of overcoming this difficulty is to have students attend campus for an examination or ship the exams to a regional testing centre or to an individual invigilator/proctor, where a supervised examination takes place. More recently sophisticated systems that include locking down students’ computers, observation by web cam and keystroke identification and other forms of recognition through biometric authentication have become available. Finally there is a pedagogical trend towards the use of many forms of authentic assessment that do not require real-time invigilation including e-portfolios and project assessment in both online and classroom environments.

Universities rightfully are very protective of their role and responsibility in assuring identity, output, competency and capacity before issuing credentials that attest to these accomplishments. We have seen generations of ‘diploma mills’ offering bogus degrees and certificates and are well aware that the reputation of the university and value of the credential to students, potential employers and the university cannot be compromised. However, the issue is complicated by the social value of scarcity. If too many people attain a degree from a particular institution, then some may feel the value and certainly the exclusiveness of the award is decreased. Open universities have long struggled against this elitist restriction on higher learning, but the proliferation of credentials and massification of higher education and supposed ‘credential creep’ still inhibits many institutions from expanding their credentialing capacity.

However, it must be remembered that from a student’s perspective, with students fees and assessment must come accreditation.

Part time versus full time faculty

No issue challenges the traditional academy more than the issue of outsourcing teaching functions to part-time, as opposed to full-time tenured faculty. In the USA, the National Center for Educational Statistics (2010) reports that the now majority of active higher education instructors in the United States are adjunct faculty. Many for-profit universities, some of which offer degrees at graduate level, pride themselves that none of their faculty are isolated “ivory tower” academics and that all are immersed in the “real world” of practice. This boast raises fundamental challenges to the nature and relevance of knowledge and qualifications to teach that knowledge. Does full time employment in the academy actually reduce ones competence or capability?

There is no single answer to this challenge, but we suspect that answers are highly discipline and context dependent. It is hard to imagine an adjunct faculty member employed, full time in industry, having the breadth, scope or relevance of knowledge that is accessible and demanded of the full time faculty member engaged in disciplines such as Shakespearean study, high energy physics or astronomy. But that same argument is harder to make in the professional faculties where active practice in education, law or medicine (to name a few) may be as, or more relevant than that of those engaged in full time study within these disciplines. Of course, this sets aside the training for and expertise in teaching in any discipline and studies do show that full time faculty have greater access to professional development training than their adjunct colleagues (Palloff & Pratt, 2011).

Undoubtedly adjunct faculty paid, in a piece work fashion for the number of courses or students they teach are much cheaper to employ than full time faculty charged with research and public service in addition to teaching. However, building an effective education program requires thoughtful content integration, knowledge of institutional politics, attention to detail and in-depth understanding of accreditation issues that adjunct faculty are neither paid for nor trained to master. Thus, strategic decisions that match institutional and discipline needs for teaching, research and service must mediate the administrative desire to hire cheaper part time faculty and the academic union desire to hire only full time tenured faculty.

We next turn to one example of an initiative recently begun by an international group of accredited universities, to pilot a radically more cost effective expansion of their education provision.

The Open Educational Resources University (OERu) Alternative

The OERu initiative is a collaboration of 13 universities on four continents that is designed to increase access to higher education by drastically reducing the cost, while maintaining quality and relying on the credentialing capacity of recognized or accredited public institutions of higher learning. The aim is to “design and implement a parallel learning universe to provide free learning opportunities for all students worldwide with pathways to earn credible post-secondary credentials” (Mackintosh, McGreal & Taylor, 2011)

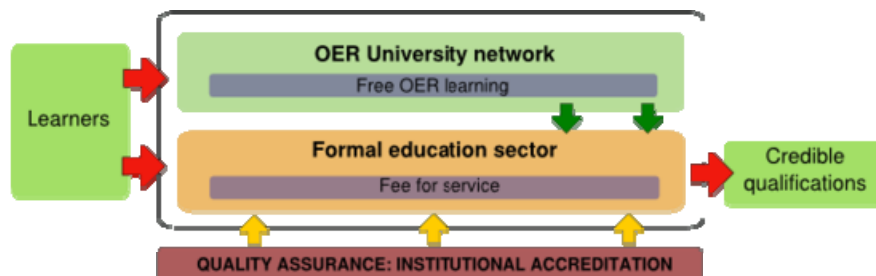


Figure 1. OERu Model from Macintosh, McGreal & Taylor, 2011

The OERu model (Figure 1) seeks to leverage and support development of courses (North America) or units (Europe) built from, or created as OER. Students are encouraged to access particular courses or any combination of learning resources (high quality student-content interaction) and to create a wide variety of peer and network liaisons (high quality student-student interaction) to learn and acquire relevant skills. Partner institutions in the consortia create or acquire OER content, examinations, activities and processes by which this learning opportunity is provided, assessed and eventually accredited. This credentialing service is to be offered at prices determined by each partnering

institution depending on their specific circumstances. But, in all cases the price will be considerably lower than the normal tuition rates.

Though simple in concept the OERu faces a number of operational challenges. There are, at present, sufficient OERs available to offer general Bachelors programmes in popular disciplines areas. However, this is not the case in many specific subject areas. In addition, the OER may have to be localized or adapted for different cultures, translated to other languages or further adapted to different levels for a wide range of institutions. Although each institution will be offering their own credential, there will be a growing need to accept the credentials of other participating institutions.

OERu Raises a number of challenging questions – both for its partners and other institutions. Can one time or end of course testing really test competence, learning and capacity without reference to any particular learning textbook or resources? Of course high stake testing for LSAT, GREs and many professional schools is not novel, however many faculty resent the lack of interaction associated with credit awarded exclusively by successful challenge of final examinations. Secondly, students will put pressure on institutions to accept transfer credits and even life long learning accomplishments for credit, that may not to be allowed under current university regulations. And finally to return to the issue of low cost service provision, will the OERu alternative disrupt or even destroy the current model of the partner institutions that is based in large part on students paying high fees for their courses and credentials?

Others are already implementing open course delivery models with some attempt at accreditation using “certificates”. In the Fall of 2011, professors at Stanford University offered courses for free to large numbers of learners, providing a letter to successful learners, independent of the university though a private company called Udacity, which hopes to monetize the students’ skills (Lolowich, 2012; Whittaker, 2012). And, in early 2012, the Massachusetts Institute of Technology has announced the formation of MITx that will offer course content and grant a certificate to successful learners, although this will not be identical to certificates or degrees offered through normal MIT registration. (News Report, 2011).

Conclusion

Network technologies and resulting social and economic innovations present disruptions to all organizations. Some industries like the sound recording and movies, retail and publishing industries have been forced to drastically re-engineer their processes and products in order to survive competition from net-based alternatives. The net is a profoundly disruptive technology. As Christenson (1997) noted, disruptive technologies are often offered at very much lower cost to traditional customers, thus opening the door to new (often low-end) markets. However, disruptive technologies, though initially providing services that are of low functionality or quality to traditional offerings, over time, often improve in many dimensions, while maintaining low cost or other competitive advantage. Thus, initial customers are not often attracted to the disruptive technology but over time they realize that an equal or better product is available at lower cost through use of the disruptive technology. We have seen this in the move to electronic watches, tablet computers, cameras, movie and sound recording products, low cost airlines, brokerages, online retailers and other services to mention just a few.

As a concrete example of this two faculty members from Stanford University sponsored a full, open online course in 2011. They were both surprised and nearly overwhelmed when over 160,000 students enrolled in the course - more than the entire student body at Stanford. Although most of these students did not complete the course 248 received perfect scores on all assignments and tests- an achievement not equaled by any of the traditional students on campus. As evidence of the potential disruption of this innovation the on-campus course dwindled from “200 students to 30 students because the online course was more intimate and better at teaching than the real-world course on which it was based.”(Salmon, 2012)

We think there is opportunity (and accompanying challenge) for educational institutions to be early adopters of low cost and no-frills model to avoid the ongoing spiral of increased costs coupled with decreased government funding and increasing student resistance and incapacity to pay high tuition fees. To make such a transition challenges many of the traditional ideals and systems of higher education institutions based on pre-net ideals and technologies. But the alternatives are also not without risk. Many will fail to adapt and go out of business; some may continue serving as elite that can afford the high costs.

The open universities have a particular challenge and opportunity to embrace these disruptive technologies and pedagogies as these initiatives speak directly to their mandate of increasing access. If both public campuses and online systems do not adapt and move to exploit these network affordances, then it leaves a tremendous opportunity that can (and will) be filled by private, for profit entrepreneurs. Whitesides (2011) tells that the race may not be to the swift, but to the cheap, noting that "affordability in the future may be the first requirement not an afterthought."

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