Online Distance Education:
Hybrid Coursework & Research Methods

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Abstract

Recent trends in education have led to the development of various mediums and methods to instruct courses and conduct research. Engineering pedagogy has evolved to include online courses and distance continuing education opportunities. Video capture, remote conferencing, and other real-time communications techniques have emerged over the past decade which allows faculty and students to collaborate across great distances. Universities around the world have developed programs aimed at serving domestic and global educational markets. Some of these universities have been leaders in online education and created best-in-class programs. There are challenges and benefits associated with online distance teaching arrangements. Examples are provided from the personal experiences of a hybrid graduate student who has taken on-campus and off-campus courses and conducted research remotely.

Introduction

Brick-and-mortar educational institutions have long been associated with traditional engineering educational degree and continuing professional education programs. Over the past decade, improvements in video capturing technologies and delivery methods have created a marketplace for undergraduate and graduate engineering coursework and research. Many universities have extension and outreach departments which serve the local community and states in which they are based. Engineering distance education programs have been an organic growth opportunity for such extension divisions. For example, Stanford University's Stanford Center for Professional Development (SCPD) in1998 announced the first entirely online degree program in electrical engineering[1]. In addition to entirely online degree programs, hybrid programs which include both on-campus and off-campus work are gaining popularity. While initially contained to executive and corporate business programs, new on-campus residency components can enrich the student experience providing the ability for student to complete some coursework and requirements remotely while still providing on-campus work to stay connected to the institution, faculty, and peers. Examples could include senior design or capstone projects.

Howell, Williams, and Lindsay wrote an article which presents recent accounts on the state of continuing education[2]. They suggest that programs need to accommodate the needs of their 'customer' such as full-time employees and those students with family related obligations. Statistics and trends cited in the article include educational/career background of students, demographic profiles, the impact and required transition of faculty, the role of technology, and competition in the workplace. The authors note that female and adult students are making up a

larger share of the college age population. The growth in demand for continuing education programs shall inherently require vast changes in all educational and training infrastructures for corporations and educational institutions. Continuing education is gaining notoriety and institutions will need to rapidly transition in order to capitalize financially and retain their current status. Those pioneering continuing and distance educational programs will have a competitive advantage in global continuing education.

Distance Education[3]

Typical pedagogic techniques involve a teacher lecturing or instructing a student, with the instructor or facilitator utilizing traditional face-to-face methods or other classroom aids. The communication mediums available include traditional classroom instruction, correspondence via mail, radio, television, VHS cassette tape, CD-ROM, DVD, and most recently the Internet. Major universities in the United States created extension and distance education programs in the late nineteenth and early twentieth centuries to address the growing need to educate students' remotely[4]. Despite being nearly one hundred years in age, the recent growth in distance education has been unparalleled since its initial conception. The primary drivers for this growth in remote education is globalization and the Internet; the birth of online distance education.

Computer technology has been one of the most influential drivers in the growth of distance education. One staggering statistic indicates that 50 percent of all Chinese engineering graduates studied their profession via a distance education program[5]. Students entering the job market at the turn of the century are no longer only competing for positions against rival students domestically. In a global economy, students are competing against their peers across the world. This increase in the global supply of engineers will require leaders to differentiate themselves by continuing their education in non-traditional fashions. One of the primary concerns of distance learning is the quality of both the material and instruction of each institution. Capper and Potashnik note that this can be combated primarily by reputation and accreditation, and the cost and affordability of remote courses offered by schools is directly related to the number of students and the services offered to students (i.e., economies of scale)[5]. As the number of students increase, delivery costs are mitigated, but support costs are increased (e.g., instructors, technical support staff, administrators). It is also imperative that continuing education programs retain the same level of quality and discipline as their traditional on-campus counterparts.

Institutions offering courses, certificates, and degrees via these channels include traditional brick-and-mortar universities, online or *virtual* universities, professional organizations, and corporations. Remote coursework epitomizes the globalization of education as students anywhere in the world can access the best educational resources in the world. Departments such as Iowa State University's Engineering Distance Education, Harvard University's Division of Continuing Education, the University of Phoenix, ABB University, and Open University are examples of partially remote, entirely remote domestic, and entirely remote foreign educational solutions. For non-degree seeking students, open source initiative such as those of MIT Open Courseware and Yale University's Open Yale Courses are gaining attention from prospective students considering the costs of higher education. All of these entities have been extremely successful in their target markets. Marketing is one of the keys to success in this branch of the higher education system: in order to attract students to such programs, institutions must

effectively sell potential students on the benefits and skills gained through their respective training programs. By browsing any professional periodical (e.g., technical trade journals, magazines, newspapers) readers are bombarded with advertisements from remote educational providers.

Domestically, the University of Phoenix is the largest private distance education provider in the United States[6]. There is one significant deviation from conventional test based education programs offered by most on-campus and online institutions and that is the incorporation of a method known as application-based learning. Application-based learning is a system designed to cultivate discussions and increase retention rates amongst students. The method calls for frequent required communications between students via discussion board postings. The University of Phoenix and Upper Iowa University are examples of institutions that utilize the application-based learning model. However, students and educators must be aware of the potential hazards created by this system. While discussion postings are a wonderful approach to bring course topics into a collaborative environment, they can detract from the actual teaching of course topics. Many online institutions do not have instructors; instead they have 'co-workers' and 'facilitators.' Potential students should carefully review these pseudo-instructors' credentials, as some of the most frequent complaints amongst online students include dissatisfaction with the program format, a misunderstanding of what is involved in the program, and a feeling that they are not learning as much without face-to-face interactions.

Abroad, Open University is a British university dedicated to researching and providing distance learning services to the world. Their mission statement reads as follows:

> "The Open University is open to people, places, methods and ideas.
>
> It promotes educational opportunity and social justice by providing high-quality university education to all who wish to realize their ambitions and fulfill their potential.
>
> Through academic research, pedagogic innovation and collaborative partnership it seeks to be a world leader in the design, content and delivery of supported open and distance learning[7]."

With nearly a quarter of a million students in 2005, Open University is a pioneer in borderless global education. The European Union (EU) has a plan in place called e-Europe[8], which revolves around the growth and utilization of e-learning programs throughout the union. This policy employs information and communication technologies (ICT's) to instruct students through various sources such as radio, television, and the Internet.

China educates a substantial portion of their students via distance education. This can partly be explained by the demographics of the nation as many still reside in small farming towns and villages and require remote access to education programs. One technique China has utilized to educate the masses is the implementation of The China Education and Research Network, or TV University System (CERNIC). Universities such as the CERNIC which enroll a large number of students and educate those students utilizing distance-learning curriculum are known as mega-universities. A formal definition of mega-universities and a list of mega-universities across the globe are available from the United Nations Educational Scientific and Cultural Organization (UNESCO) [9]. Figure 1 provides the largest mega-universities by enrolled students, in

thousands[5, 6]. It can be observed that the United States needs to expand its distance education offerings if they aspire to catch up with the world leaders in the field, such as Turkey and China.

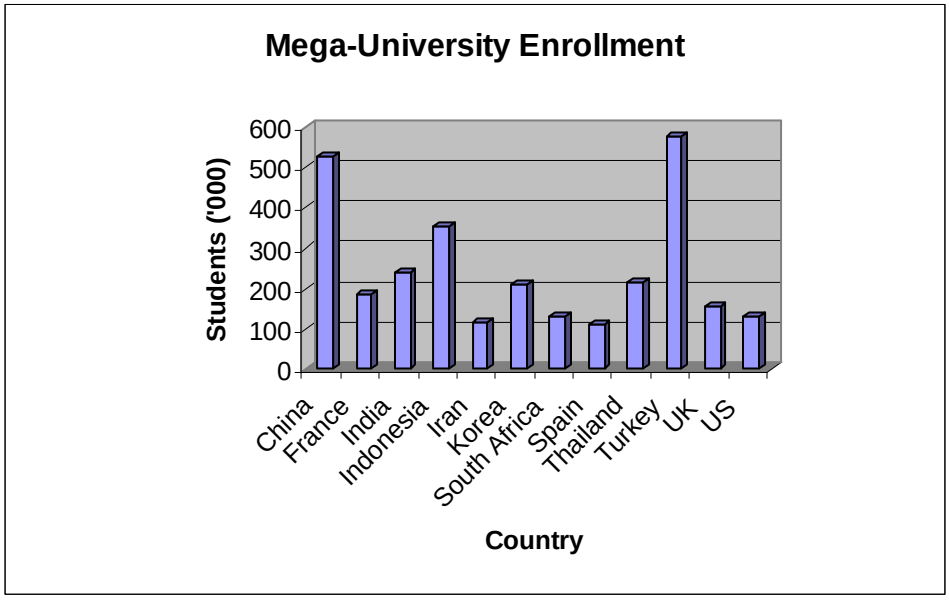

Figure 1. Mega-University Enrollment Statistics by Country in 2005 [5, 6]

So how do universities market their programs to prospective students and what should students consider when evaluating potential suitors? Reputation stills appears to reign as the dominant variable in evaluating an individual's educational credentials. According to an article in the Boston Globe, surveys indicate that private and public sector analysts stigmatize online degrees, especially those from institutions without brick-and-mortar campuses[10]. Thus the quality of the program shall weigh heavily on student evaluation when considering potential enrollment. U.S. News and World Report recently announced changes to their engineering school ranking system by working with the American Society of Engineering Education (ASEE) after questions were raised regarding the ranking system's accuracy[11]. The school which is the subject of the article, the University of Southern California, has been a very aggressive marketer for their online engineering programs offered by the Viterbi School of Engineering.

Bourne, Harris, and Mayadas reference the Sloan Consortium's members which offer over 600 online programs and the use of "blended" on-campus and online educational programs[12]. The authors of this paper reiterate the supply and demand market which has emerged from online distance education; there is fierce competition between institutions offering programs (suppliers) and students (demand). After selecting a program a student must consider the availability of resources to successfully complete coursework and research activities. As is the case with most academic programs, student learning outcomes are greatly impacted by the effort put into completing the requirements of the program.

Student Experience

Many non-traditional programs exist today for students with multiple commitments. Distance education provides a means for students to participate in coursework and research at times

convenient for their schedules. The most common contemporary mode of communication is Internet-enabled online coursework. Online programs present unique challenges and advantages when compared to traditional classroom lectures and discussions. There is an on-going debate regarding the participation of remote students; some believe that there is less participation in non face-to-face interactions while others believe there is actually greater participation (e.g., students are less nervous behind a keyboard). It is believed that online courses facilitate greater interaction from students that would normally be perceived as introverted during a classroom formatted discussion. There is little doubt that face-to-face interactions remain one of the most powerful means of communication as one can pick up on body language, verbal cues (e.g., such as tone, pitch, and inflection), and the physical demeanor of others. Another drawback to online courses is that there are also fewer networking and relationship building opportunities. One contemporary example where social networking has been made possible is in the use of social networking sites (e.g., Facebook, LinkedIn) and avatar-based communities (e.g., Second Life).

A survey conducted by the University of Cincinnati found that the Internet and CD-ROM were the preferred methods of distance course delivery[13]. Video captured lectures and coursework allow students the ability to watch course lectures on-demand. Downloads allow students to watch lectures while traveling virtually anywhere (e.g., site offices, automobiles, airplanes, trains, home, etc.). Iowa State University's Engineering Distance Education Department allows students to download and/or video-stream lecture content. Harvard University's Extension School allows student to video-stream lecture content. Software suites, such as Blackboard's WebCT, provide an interface for the course work and serve as a means to distribute materials. Conferencing mediums such as traditional teleconferencing services, free web-based teleconferencing services (e.g., Instant Conference), Microsoft Net Meeting, Sametime Meeting, Skype, Cisco WebEx, and Adobe Connect provide tools to have remote collaboration on projects. Skype serves as a useful web video conferencing tool which allows remote participants to join in real-time meetings and the basic service is free.

Remote research involves other considerations; the primary of which is the institutional library system. In order to conduct an appropriate literature review in any research area, it is critical that the student have access to adequate library resources. Most universities have some form of an electronic or e-library available to students (e.g., Iowa State University e-Library, Harvard University Libraries, etc.). This provides the student with a means to search journal articles and archives. One of the roadblocks to online engineering programs has been the accessibility of labs. To combat this, some instructors have begun to develop experiment kits which can be mailed to students in advance for completion of laboratory work[14].

It is important that a student be able to work with faculty and staff remotely in a professional manner. Students need to respect remote faculty as they would in an on-campus relationship and likewise faculty members need to understand the demands faced by remote, non-traditional students. In order for such hybrid programs to flourish communication is critical. The requirements established by university administrative offices, such as forms, need to be accessible for completion by off-campus students. To prevent the deterrence of prospective students, cumbersome and/or archaic requirements should be revised or relaxed for ease of completion. However, this must be accomplished without sacrificing any of the degree program requirements which could in tarnish credibility or reputation.

The incorporation of on-campus residency components, either mandatory or optional, helps build a sense of community involvement with the institution and colleagues. Business schools often utilize residency requirements to bring students together to work on cases or practical examples. The same concept can be applied to engineering education to solve problems or investigate specific scenarios. Descoteaux et al. discuss the importance of on-campus residency in detail[15]. Some programs require students to observe oral examinations so that they are better prepared for their own examinations (e.g., dissertation defenses). Such exam observations are part of the academic systems as most colleges and universities. Residency also provides students with the ability to ask questions and participate in discussions face-to-face rather than via phone and e-mail. This creates rapport between students and faculty which can not be replicated by technology.

The end result of any online distance education program must be the attainment of course and program objectives and learning outcomes. Goodson et al. citing a study conducted by T.L. Russell showed that there are "…no significant difference in learning outcomes based on delivery format[16]." Resources such as industry advisory boards and continuing education and learning programs can provide resources and recommendations when forming online distance education programs and courses. At Iowa State University, there is an on-campus Center for Excellence in Learning and Teaching (CELT) which provides resources and services to faculty and students.

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