

Exploring the Requirements and Infrastructure to Develop Online Degree Programs

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Abstract - *This paper presents the fundamental aspects that must be considered to develop online programs. The pros and cons associated with online education are discussed. The resources and requirements (infrastructure, software, tools, and training) needed to develop online degree programs are discussed. This paper provides a survey of tools and software programs available in both the private and public domains. We discuss the fundamental requirements, and the overall effort of implementing online degrees in terms of technology, infrastructure, online course development and faculty training.*

Keywords: Online Degree, Course Management Tools, Course Management Software, Online Education, Online Infrastructure

1 Introduction

Online education has seen dramatic growth over the last few decades. Online education has significantly increased in popularity among students of all ages. Online learning allows universities to increase their enrollment by creating distance learning programs. Distance learning programs provide a flexible and convenient way for students to further their tertiary education. Online courses can be accessed by students at any time without decreasing the quality of education that is achieved in on-site degree programs or online courses. Today, online learning has become a mandatory addition to many universities degree programs because, it affords students from varying backgrounds and circumstances the opportunity to further their education [23]. Many universities [3] have leveraged the benefits of online education and students are responding positively to this change and reaping the many benefits.

The paper is organized in the following manner. Section 2 discusses some pedagogical pros and cons of online education. Section 3 presents infrastructure needs, educational tools, commercial and open source software for managing online programs, along with various institutions and companies that develop online course content. Section 4 provides a cost and benefit analysis. Section 5 presents the groundwork to implement an online degree program. The paper concludes with section 6.

2 Advantages and Disadvantages of Online Education

Online Education was not originally popular; however, the internet and the ubiquity of technology have impacted online learning positively. Online Education is responsible for increased student enrollment and access to higher education from anywhere across the globe. There are some fundamental reasons that support the viability of online education. First, millennials typically choose non-traditional education to start and advance their careers while completing and furthering their education. Second, the down-turn in the US economy forced people to upgrade/change their career through online educational programs.

With the increased popularity of online education, there are notable advantages and disadvantages that result when compared to the traditional education system. The advantages include convenience, reduced cost and flexibility of available technology [24]. In particular students are not restricted by their geographic location, they do not have commute and pay house expenses, and they can access school work from anywhere. The increased access also allows universities and international students to avoid visa and immigration problems. Online education also presents some disadvantages, namely inadequate social interaction with peers, technology cost and assessment and instructor issues. Online students may experience a lack of face-to-face dialog with instructors, high dependence on high speed internet, and may have attain technical trouble shooting skills to handle technical problems. Additionally, traditional instructors accustomed to handouts may have a difficulty adapting to the online systems and software.

Note that some of the disadvantages mentioned are also experienced in the traditional education system. Typically, unmotivated students who do not show up for class usually do not perform well. Exposing students to new technology and troubleshooting issues is an additional benefit, as it allows them to master the technology they have to work with, these skills will serve them well beyond the online classroom [24]. Faculty members who have rooted themselves in the sanctuary of campus based face to face education are the most vocal critics of online education.

3 Infrastructure and Software Needs for Online Education

We discuss and summarize some of the infrastructure and software needs that are required to develop an online degree program.

3.1 Online Infrastructure

All educational endeavors are systems, made up of various interconnected components. In distance education, understanding how the entire system of course development and delivery occurs, and how these systems link to services and other components are important aspects of ensuring effectiveness and quality. In order to create high quality videos, a controlled and well equipped environment is necessary to record online classes. The various communication mediums have to be clear and succinct without delay and distortion, because students rely heavily on excellent communication to carry out their studies remotely.

Additionally, SMART Boards [35] have been adopted by many universities since they combine the simplicity of a whiteboard with the power of a computer. The SMART Board interactive whiteboard allows for the delivery of dynamic lessons, write notes in digital ink and save your work – all with the simple touch of a finger. The SMART Board uses an integrated SMART projector which limits shadows and projects quality image, making visuals crisp and bright.

Servers [21] are required to store and retrieve recorded videos and any other course material. Power Supply system sources should always be available to power the server and its associated sub-systems (cameras, SMART Board and mikes) to ensure that the content is not lost.

3.2 Software and Tools

Online education relies heavily on special tools and technologies in order to create a successful and functional learning environment. There are a variety of tools on the market that provide the resources needed by instructors and students. Wimba [40] and Blackboard [7] are two widely used products for supporting online learning.

Wimba provides educators and students the ability to build relationships by combining interactive technologies with instructional best practices. Wimba contains many capabilities which include support of audio, video, application sharing, and content. Wimba has advanced features such as polling, whiteboarding, presenter on-the-fly, resizable chat areas and participant lists, usage analytics tools. Wimba uses Voice over IP to afford natural communication; it modulates tone of voice, captures body language and conveys the natural enthusiasm and interest of the professor.

Wimba affords flexibility in that, a wide variety of cameras used on computer systems or devices will be compatible with Wimba. This allows students to obtain the benefits of online instruction without the hassle of incompatibility issues. This reduces help desk support for students. Additionally, Wimba provides SSL encryption for classroom traffic thus reducing disruption from outside intruders whilst upholding the standards of learning.

Wimba can be easily integrated with Blackboard through Blackboard Collaborate. *Blackboard Collaborate* [8] manages pre-session planning and post-session recording management tools that support the entire instructional cycle. Blackboard collaborate allows students and professors to view classroom recordings on a desktop or easily convert for download or streaming to any mobile device to meet the needs of on-demand active learners.

Blackboard provides institutions the ability to develop and implement a learning management system that impacts every aspect of education. Blackboard allows professors to engage students in exciting new ways, reaching them on their terms and devices - and connecting more effectively, keeping students informed, involved, and collaborating together.

ANGEL Learning Management Suite (LMS) [4] is a tool for creating virtual learning environments for online learning. A learning management system (LMS) is a software application for the administration, documentation, tracking, and reporting of training programs. ANGEL is used to offer hybrid or blended (web-enhanced) classes. In addition to creating courses, and adding content, ANGEL also has features such as pattern recognition of online student activity, assessment tools that measure learning outcomes against class objectives.

Mentor Course Management System (CMS) [6] provides tools to manage work outside of class or teach fully online courses. The Mentor platform includes functionalities for course management, assessment, tests, grants management and faculty evaluations.

eFront [17] allows instructors to create of online learning communities while offering various opportunities for collaboration and interaction through an icon-based user interface. The platform includes tools for content creation, tests building, assignments management, reporting, internal messaging, forum, and surveys.

Sakai Collaboration Learning Environment (CLE) [33] is a free learning management, research and project collaboration, e-portfolio source. Sakai uses tools, for maintaining Learning Management System (LMS) learning management platforms such as presentation, profile, schedule, assignment, gradebook, assessment, syllabus, forms, glossary and reports.

ILIAS [22] is an open source Learning Management System (LMS) which offers features to design and run online-courses. These features include creating learning content, offer assessments and exercises, run surveys and support communication and cooperation among users. It contains modules like course management, groups, virtual classroom, chat, discussion and forums.

Online Learning And Training (OLAT) [28] is an open source Learning Management System (LMS) which is available in a variety of languages and provides diverse functionalities in web-based learning and training. OLAT includes standard modules for learning delivery and course management like content managing, forums, file discussions, quizzes, logs, podcast, assignment submissions and e-assessments.

3.3 Companies Offering Online course Development Support

Developing an online course requires a different way of planning, presenting and delivering course content to distant learners. Online course development requires new skills. Several institutions and companies [19] provide assistance with online course development. Higher Education institutions offering courses online to meet increasing demand often times, procure outside help to develop or design their digital curriculum. The American Distance Education Consortium (ADEC) [2] is a non-profit distance education consortium. The consortium was developed to encourage the creation and delivery of quality, economical distance education programs and services to diverse audiences. ADEC utilizes subject matter specialists and information resources to share knowledge and content with learners. ADEC offers assistance locally, regionally, nationally, and internationally. Their focus includes helping institutions with design for active and effective learning, develop and maintain the technological and human infrastructure [2].

Accel Media [1] provides training and services centered on online course development and assessment. They convert existing traditional courses into online courses, create instructional curriculum design, voice-over narration, art and graphics. Additionally, Accel Media provides technical support to users, host, manage and update online courses. *Mindflash* [25] uses existing training content to build interactive web-based courses in a timely fashion. They include features and tools for training, deployment, and progress management for online courses. *TestOut* [36] offers interactive and intuitive tools that support effective communication and delivery of technical courses such as networking, CISCO certification and security online.

Velsoft [38] provides a courseware that includes content and training material that allows institutions to create, customize and manage mobile friendly, non-technical online courses. *Skye Multimedia* [34] offers a virtual web based technology, called Reflect, that can be combined with

classroom training to reinforce traditional teaching methods. *Reflect* [32] provides a broad training solution by taking learners through a cycle of instruction, demonstration, practice, review and feedback. *Digital Latitude* [16] offers custom E-Learning course development and instructional design for a variety of companies. Their product offers off-the-shelf, semi and custom courses, in addition to software that monitors the progress made by participants in each course.

Colloquy [13] offers online course development solutions to facilitate the financial and technical challenges institutions experience when taking their courses online. Colloquy also offers marketing and recruiting, curriculum design, development, learning management systems, and student success services. *The Learning House* [37] helps universities to create, manage and grow online degree programs and courses. They also provide the following services: market research, marketing and lead generation, admissions and enrollment management, student retention, curriculum development and management, faculty training, professional development, learning management systems and 24/7 technical support.

3.4 Open-Source Software for Online Course Development

There are several open source software available for online course development and for customizing courses using predesigned course templates. An existing course can be enhanced with the addition of embedded videos, links and tasks. These software are most suitable for descriptive or non-computer science courses. However, they can allow for the development of needed computer science courses within the available framework. The two most famous are: WebQuest [39] and HyperInquiry [20].

WebQuest [39] uses a bottom up approach to develop non-technical courses online. A WebQuest is an inquiry-oriented lesson format in which most or all the information that learners work with comes from the internet. It consists of embedded videos, links, assessment, and information surrounding a topic. WebQuest has a variety of different course templates that can be used by instructors to quickly and effectively develop an online course.

HyperInquiry [20] uses an inductive approach to design non-technical courses online. HyperInquiry is based on a three phase model which encapsulates concept, interpretation of data and application of principles. This approach encourages students to understand, extrapolate, and apply information by coaching them to identify patterns for learning different topics.

Coursera [14] is an educational technology open source organization, which offers massive open online courses (MOOC) [31]. Coursera works with other universities to make some of their courses available online in engineering,

humanities, medicine, biology, social sciences, mathematics, business, computer science, and other areas. Each course includes short video lectures on different topics and assignments are submitted on a weekly basis. Web forums are provided for courses, and students can arrange face to face study meet-ups using meetup.com, or online meetups. Currently, Coursera has partnerships with 107 institutions and universities.

Course Builder [15] is new open-source software released by Google. Course Builder is a tool that universities can use to deliver free online courses. Course Builder is a joint partnership between Google, Harvard University, the Massachusetts Institute of Technology, and the University of California at Berkeley to offer free online courses. Google tested the software in summer 2013, by offering a course called Power Searching, which attracted 155,000 registered students. Course Builder is available for download, but its installation requires strong technical skills and a server to run it on.

iTunes U [5] is a new application software created by Apple, that gives instructors the capability of creating courses for students on an IPAD. The courses can be created using multiple formats such as audio videos, presentation, documents, and iBooks for ipads. It allows students to integrate with iBooks and other apps thus allowing them to keep abreast with courses. iTunes U app stores documents, notes, highlights, and bookmarks up to date across multiple devices.

Moodle [26] is an open-source alternative to Blackboard. Moodle is a free learning management system which provides functions for assignment submission, discussion forum, files download, grading, online quizzes and announcement.

OpenClass [29] is a free course-management system, which is completely Cloud based and is available under an open-source license. OpenClass provides a dynamic learning environment that helps educators bring social learning and experiences to students. OpenClass allows instructors to create courses, add content and manage course in one place. Students can access content via a computer or via mobile devices.

Canvas [11] is an open-source learning management system. It allows instructors to create assignments, share course information, and integrate assignments in the course calendar. It allows students to integrate their accounts with social media sites such as Twitter and Facebook. Individual Students and instructors who are not affiliated with a school can use the program for free.

4 The Foundation to Implement an Online Degree Program

Based on demand and the changing dynamics of universities globally, and the goal to attract more students, it may be worth while for smaller traditional universities to offer online degrees completely online at the undergraduate and graduate level. There are some significant foundational units that must be implemented before the development of an online degree program begins. The following guidelines show the fundamental units that are required to meet this objective:

4.1 Form Committees

It is important to establish administration, curriculum and course development, technology, finances and committees [27]. These committees will be responsible for:

- Identifying important participants, identify subject matter experts, and instructional designers.
- Leveraging the experiences and knowledge of individuals from a number of different disciplines and knowledge bases.
- Ensuring that individuals have unique and compatible skills sets.
- Establishing ground rules on how to share ideas and debate topics.

4.2 Collaboratively Develop Course Content

There are several models that can be used to accomplish this objective as outlined in [18], the process includes:

- Exchanging ideas and determining what content is needed.
- Developing assessments for the different course objectives.
- Selecting the appropriate resources for the course.

4.3 Develop Rubrics

A rubric can serve several beneficial purposes. A rubric can be used in a course as a self-evaluation tool to advise instructors how to revise an existing course. It can also be used for the design of a new course for the online environment by following the rubric as a road map [10]. Develop an online rubric:

- After the assignments have been developed collaboratively among the team, the rubric can be developed.
- The development of rubrics will standardize certain areas of the content that will be assessed which are connected to course objectives.

- The validity and reliability of the rubric must be evaluated.

4.4 Assessment

The primary function of the assessment is to measure student learning. There are two types of assessment, formative and summative. Formative happens while the instruction is in process, while summative is a final overall determination [30]. The assessment committee is tasked with the following responsibilities:

- Assuring that learning objectives are covered.
- Ensuring that the needed changes/ improvements to course assignments are done.
- Ensuring that all program outcomes are considered.
- Analyzing how the interactive learning opportunities were experienced by students.
- Determining if assignments adequately cover student learning outcomes.
- Determining what was missing from the course.

5 Analysis

One primary goal of universities that offer online degrees is to ensure quality and flexible education that is consistent with the current educational climate. More universities and community colleges are offering blended and online courses to meet the needs of the students they target. In order for institutions to remain competitive it may be beneficial to consider meeting the needs of diverse students. Online courses are geared towards student needs on a broader platform, this can increase student enrollment. The following aspects are essentials to develop an online degree program:

5.1 Initial Technology and Infrastructure Needs

There is an increasing range of user interfaces, physical devices and supporting infrastructure that facilitate online learning. It is important to meet with different information and communications technology (ICT) infrastructure providers [21] to get an estimate of the overall cost to develop an online program on a scale that is consistent with the requirements [9, 12]. Technology and infrastructure needs can become quite costly, however, there is the option of procuring the services of companies that offer the technology, server space, databases storage and online facilities that will support our online courses.

Most universities use some form of course management system, such as Blackboard for example. Integrating video lectures into the existing course management software used in your university is encouraged to reduce cost. Video lectures are useful as students can

access them at any time. Generally, the infrastructure and technology needs in most universities may include a Cloud, some workstations and the appropriate software (operating system and applications) to develop and manage the online program.

5.2 Course Development and Faculty Training

Effective online course development, management and training will determine the success of online courses. The strength of online education is not only contingent on the medium it uses but in the way it is used. Similarly, online course development and training is provided by companies and other institutions at a cost. It is important to train faculty and staff members by sending them to various workshops, conferences, and professional seminars. Strong consideration must be given to training the faculty specifically for online teaching as well as the time allocated for training. Instructional design support and guidelines can help instructors get acclimated to this new form of teaching. The trained instructors can be utilized as mentors for new faculty members for future training or professional development efforts.

6 Conclusions

The rapid educational changes and learning needs of students require the enhanced benefits that online education offers. These benefits allow universities to expand and diversify their student body as well as their degree programs. However, the cost including infrastructure, faculty training and maintenance, must be thoroughly evaluated before implementing an online degree program. The benefits of online education include facilitating existing residential students, who may complete their degrees earlier because of the availability of certain online courses. Due to the success of universities who offer online degree programs a wide variety of effective tools, and course management software are now available free of charge. Additionally, universities should also consider the challenge online degrees have on instructors who are accustomed to teaching in the traditional class format. Instructors will have to learn the tools, course management software and find innovative approaches to convey knowledge through the online platform. In order to advance in pedagogy, and remain competitive it may be worthwhile for universities to at least explore the online direction.

7 References

- [1] Accel Media. (2014). We Build Online Courses. Retrieved from: <http://www.accelmedia.com/about.html>.
- [2] ADECO. (2013). "The American Distance Education Consortium". Retrieved from: <http://www.adec.edu/>.

- [3] American School Search. (2014). "Colleges and Universities", Retrieved from: <http://www.american-school-search.com/colleges/hbcu>.
- [4] ANGEL LMS. (2014). "ANGEL Learning Management Suite". Retrieved from: http://www.angellearning.com/products/lms/whats_new_74.html.
- [5] Apple. (2014). "iTunes U". Retrieved from: <http://www.apple.com/education/ipad/itunes-u/>.
- [6] AxiomEducation. (2014). "Course Management". Retrieved from: <http://www.axiomeducation.com/manage-courses-curriculum-management/>.
- [7] Blackboard. (2014). "About BB". Retrieved from: <http://www.blackboard.com/>.
- [8] Blackboard Collaborate. (2014). "About Blackboard Collaborate". Retrieved from: <http://www.blackboard.com/platforms/collaborate/overview.aspx>.
- [9] Kerry Blinco, Jon Mason, Neil McLean and Scott Wilson. "Trends and Issues in E-learning Infrastructure Development", White paper, July 19, 2004. Retrieved from: http://www.jisc.ac.uk/uploaded_documents/Altilab04-infrastructureV2.pdf.
- [10] California State University. (2009). "Rubric for Online Instruction". Retrieved from: http://www.csuchico.edu/roi/the_rubric.shtml.
- [11] Canvas. (2014). "The University of Texas at Austin", Retrieved from: <http://canvas.utexas.edu/>.
- [12] Center of Digital Education and Converge. (2013). "Smart Infrastructure", Special Report. Retrieved from: http://images.erepublic.com/documents/CDE13+SPQ1_V.PDF.
- [13] Colloquy. (2014). "Solutions Overview". Retrieved from: <http://colloquy360.com/>.
- [14] Coursera.(2013). "Our Mission". Retrieved from: <https://www.coursera.org/>.
- [15] Course-Builder. (2014). "Welcome to Course Builder!" Retrieved from: <https://code.google.com/p/course-builder>.
- [16] Digital Latitude. (2014). "Intelligent e-learning solutions". Retrieved from: <http://www.digital-latitudes.com/>.
- [17] eFront.(2014). "5 Reasons to choose eFront". Retrieved from: <http://www.efrontlearning.net/>.
- [18] Emily Hixon. "Team-based online course development: A case study of collaboration models", Online Journal of Distance Learning Administration, 2008. Retrieved from: <http://www.westga.edu/~distance/ojdla/winter114/hixon114.html>
- [19] Hobson. (2014). "Higher Ed Institutions". Retrieved from: <http://www.hobsons.com/education-professionals/higher-education/>.
- [20] HyperInquiry. (2014). "Instructional & Learning Strategies". Retrieved from: <http://www.southalabama.edu/coe/bset/dempsey/isd613/summer04/unit/wq/hyperinquiry.html>.
- [21] IBM. (2013). "Buy BladeCenter HX5 Featured Models". Retrieved from: http://www-304.ibm.com/shop/americas/content/home/store_IBMPublicUSA/en_US/evp/hx5.html.
- [22] ILIAS. (2014). "Using ILIAS". Retrieved from: http://www.ilias.de/docu/goto_docu_cat_580.html.
- [23] Daphne Koller. "How online education can create a 'global classroom'", CNN special report, June 21, 2013. Retrieved from: <http://edition.cnn.com/2013/06/21/business/opinion-koller-education-petersburg-forum>.
- [24] Dhirendra Kumar. "Pros and Cons of Online Education", Manuscript, 2010, North Carolina State University, Raleigh, NC, USA.
- [25] MindFlash. (2013). "Easy Online Training". Retrieved from: <http://www.mindflash.com/>.
- [26] Moodle. (2014). "About Moodle". Retrieved from: http://docs.moodle.org/26/en/About_Moodle.
- [27] Priscilla O. Okunji and Mary H. Hill, "Undergraduate Online Program Development, Implementation and Evaluation: A Pilot Study", Canadian Journal of Nursing Informatics(CJNI), 8, 3, September 23, 2013.
- [28] OLAT.(2014). "Welcome to OLAT". Retrieved from: <http://www.olat.org/>.
- [29] OpenClass. (2014). "Who Uses OpenClass?". Retrieved from: <http://www.openclass.com/who>.
- [30] Joanna Palmer, Donna DiMatteo-Gibson, and Linda Phillips. "Building a Stronger Online Course/Program: Implementing a Six Step Collaborative Development Model", Sloan-C Conference 2013 International Conference on Online Learning, 2013. Retrieved from: <http://sloanconsortium.org/conference/2013/aln/building-stronger-online-courseprogram-implementing-six-step-collaborative-devel>.

[31] Laura Pappano. "The Year of the MOOC". The New York Times", November 2, 2012. Retrieved from: <http://www.nytimes.com>.

[32] REfLECT. (2014). "REfLECT classic". Retrieved from: <http://www.ifl.ac.uk/cpd/reflect/reflect-classic>.

[33] Sakai. (2014). "Explore the Sakai CLE". Retrieved from: <http://www.sakaiproject.org/>.

[34] Skye Multimedia. (2014). "iReflect". Retrieved from: http://www.skyemm.com/products.html?product=ireflect#header_placeholder.

[35] SMART. (2013). "Smart Boards". Retrieved from: http://smarttech.com/smartboard_

[36] TestOut. (2014). "LabSim Educational Solutions". Retrieved from: <http://www.testout.com/home/educator-resources/labsim-educational-solutions>.

[37] The Learning House Inc. (2014). "what we do". Retrieved from: <http://www.learninghouse.com/>.

[38] Velssoft. (2014). "Velssoft". Retrieved from: <http://www.velsoft.com>.

[39] WebQuest. (2014). "What is a WebQuest?". Retrieved from: <http://webquest.org/index.php>.

[40] Wimba. (2014). "Wimba Classroom for Higher Education". Retrieved from: http://www.wimba.com/solutions/higher-education/wimba_classroom_for_higher_education.