Hartwick College

An In-depth Analysis of Online Courseware

How has it changed the way we learn?

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Research Question

How has the use of online courseware changed over the last three decades (1990 - 2017) to better suit students and their academic needs considering the advancements in web-technology?

Introduction

Online education has developed and grown tremendously over the past three decades due to the advancement of technology. Higher internet speeds, better storage technology, and improvements to web languages have brought forth new innovations including cloud computing, Google web applications (e.g. Google Drive, Google Photos, etc), and better online courses including Lynda and Coursera. In this paper, I will focus on the following key areas as they relate to online courseware: (i) History, (ii) Advancement of Technology and (iii) Applications of New Innovations to demonstrate how new technology developments within these areas have positively impacted online courses.

History

Over the last three decades the internet and the World-Wide-Web (WWW) have created vast opportunities for education. The rapid improvement of technology has made teaching and learning outside of the traditional classroom possible for teachers and students. According to Dilani Gedera, “E-learning can be defined as the use of educational technologies to design, deliver, and manage both formal and informal learning and knowledge sharing at any time, any place and any place”. Historically, teaching was done within the confines of a classroom with strategies including discussions, lectures and field trips to encourage the learning process. However, with the developing demand for education and insufficient funding for expanding

facilities at many schools, colleges and universities have altered the traditional means of delivery. With the advent of the internet and the World-Wide-Web along with the communication and information revolution that began in the early nineties, our perspective of teaching and learning has shifted, and therefore, classrooms are no longer the only setting for education.

Online programs have become a worthwhile solution for present-day education. According to Karber (2003), the increased flexibility of online courseware has helped a plethora of self-motivated students who want to earn a degree on their own time while supporting themselves and their families. Nowadays, students and professors are no longer separated by time and distance. “Online programs serve as a catalyst to enable the paradigm shift to take place in education, making educators/academics think about and study how such programs are best delivered.” (Chi-Sung, Li).

The internet as it exists today would not be possible without the culmination of many different technologies and fields of research. According to Dave Wallace, “We can categorise some of these as: The physical (network infrastructure), the logical (information organization and transport), the representational (how we represent the data) and the interactive (how we interact with the data)”.

In the year 1990, Tim Berners-Lee, who worked at CERN, invented the World-Wide-Web, HyperText Transfer Protocol (HTTP), the HyperText Markup Language (HTML) and the first Web browser. These technologies provided the fundamentals for how we access the web. Additionally, in the years 2000 - 2004, Cascading Style Sheets (CSS) was

invented. This laid the groundwork for creating the dynamic websites we know of today by separating the styles (CSS) from the content (HTML).

The web has grown and evolved immensely since the first web-page was created. A web page is hosted on a web server, which is essentially another computer that is always on and is connected to the internet. A web server is powered by server-side-technologies that include programming languages such as PHP, Java, ASP.NET, Python, Ruby (with Ruby on Rails), and others. Through the use of these languages, one can change the content on the page or have the computer complete a complex task. For example, one can program the computer to grade an assignment in an online course. These languages have developed over time to incorporate better tools for the developer to create more dynamic websites. Below is a timeline of key events in the history of these languages and frameworks.

Table 1: The evolution of the web-based programming languages.

Year	**Programming Language Innovation**
1993 - 1997	Python 1.0 - 1.4, PHP 1.0, Ruby, ASP 1.0 - 2.0, Java servlet 1.0, CSS 1.0, Javascript 1.0, HTML 1.0 -3.0
1998 - 2002	PHP 3 - 4, Java servlet 2.1 - 2.2, Python 2.0 - 2.2, ASP.NET 1.0, CSS 2 - 3, Javascript 2.0, HTML 4
2003 - 2007	ASP.NET 1.1 - 3.5, Java servlet 2.4 - 2.5, Python 2.3 - 2.5, PHP 5, Ruby on Rails 1.0 - 2.0, Symfony 1.0, Django, CakePHP, Javascript 3 - 5, jQuery 1.0-1.2
2008 - 2012	Ruby on Rails 2.1 - 3.2, jQuery 1.3 - 1.8
2013 - 2017	HTML 5.0, jQuery 1.9 - 3.2, Ruby on Rails 4.0 - 5.1

Compiled by personal research.

In summary, these tools are beneficial to the construction of online courses because they have allowed professors to create online courses with dynamic content such as auto-graded assignments, community discussion forums and recorded high-definition video lectures. Without these tools, the internet would have remained as a means to only obtain information rather than interact with information.

Benefits

There are a number of benefits of taking an online course. According to Coyner and McCann (2004), "Accessibility is one of the most essential benefits. Students can gain access to information including syllabi, course assignments, scoring guides, powerpoint presentations, and supplemental materials 24 hours a day and seven days a week". Online courses provide students with increased flexibility in their use of time. Furthermore, because of the availability of information, students have the advantage of studying in any location at any time according to their schedule. Teachers, can also enjoy the increased flexibility saving time on traveling to and from campus. Online education is also highly affordable because "most people have their personal computers and internet connection at home and the tuition costs can be lower because of the reduced use of physical classrooms and other traditional classroom resources" (Chi-Sung, Li).

Challenges

Even with the growing list of benefits of taking and/or creating an online course, there are challenges that exist. One is the significant upfront planning and organization required to construct a viable online course. Translating the entirety of a course traditionally taught in a

contemporary classroom to a web-based environment is another hurdle instructors must overcome.

With the use of technology comes challenges with teaching online and taking online courses. “Materials currently used in a classroom setting may or may not be compatible with the electronic format, and some elements, such as video clips, may not be accessible to students” (Chi-Sung, Li). Also, teachers may struggle with a lack of technical support for the platform used to create an online course.

Another major hurdle is the expectations of online students. Because students have controlled access to content, teachers are therefore expected to provide instantaneous feedback whenever a question is posed or an assignment is submitted. To minimize the flow of emails and maximize communication with the whole class, Taylor (2003) urged instructors to post the student's questions and the instructor's answers on the classroom discussion board.

Advancement of Hardware Technology

Since the advent of the Word-Wide-Web in 1992, the web has become a more demanding setting for computers and their hardware. According to Dave Wallace, “24 hours of video is uploaded to YouTube every minute and more than 30 billion pieces of content (web links, news stories, blog posts, notes, photo albums, etc) are shared each month in over 70 languages”. Such exponential statistics require demanding hardware to process and access. The following chart showcases how much each of the core components of a PC’s hardware has advanced in the last 22 years to support the dynamic content that is seen across the web nowadays.

Table 2: A visualization of how much technology has improved in the last 22 years.

Part	**1995 PC**	**2017 PC**
RAM	8 MB @ $400 per 4 MB	16 GB (common) @ $4.37 per 1 GB
Hard Drive	400 - 1000 MB	500 GB is low end… which is 500,000 MB. 500 GB can be as low as $39. TB drives are common (1,000,000 MB) for less than the cost of a 1994, 400MB drive
Processor	33MHz	4,000 MHz+ with multiple cores and countless optimizations (clock speed is not a clear measurement for processing power)
Graphics Card	24-bit accelerated	PCI Express 2 (replacing PCI, and then AGP) with 4-6 GB of dedicated RAM, for about $549

Compiled by personal research.

Improvements in a computer's hardware is what defines the limits of what we can and cannot do on a computer. In order to have such advanced languages, as discussed earlier, one would need capable hardware to take advantage of the software that one would develop with the aforementioned languages. For example, improvements in Graphics Card technology has allowed developers to expand the realism in video games such as Halo, Call of Duty and others by improving languages to take advantage of the new hardware.

Applications of New Innovations

"Cloud computing is an emerging new computing paradigm for delivering computing services" according to Nabil Sutlan. Essentially, cloud computing allows individuals to access, store and manipulate content that is not on one's own devices' hard drive. This emerging paradigm in computing would not be possible had not the hardware and software improved to the point that it is today. One well-known company that allows this type of computing is Google. One popular service offered by Google is Google Apps. "Google Apps is a collection of Web-based messaging (e.g. Gmail, Google Talk and Google Calendar) and productivity and collaboration tools (Google Docs, Google Spreadsheets and Google Slides)" (Sutlan, Nabil). These web-applications are used immensely in and out of schools.

In a study that looked at the use of Google Docs in collaborative writing versus using a more traditional medium found that "Google Docs changed the means of communication used during collaborative writing" (Zhou, Wenyi). As shown in Figure 1 below, a higher percentage of the students (nearly 20%) used Google Docs in their second assignment as compared to the first assignment and other communication mediums.

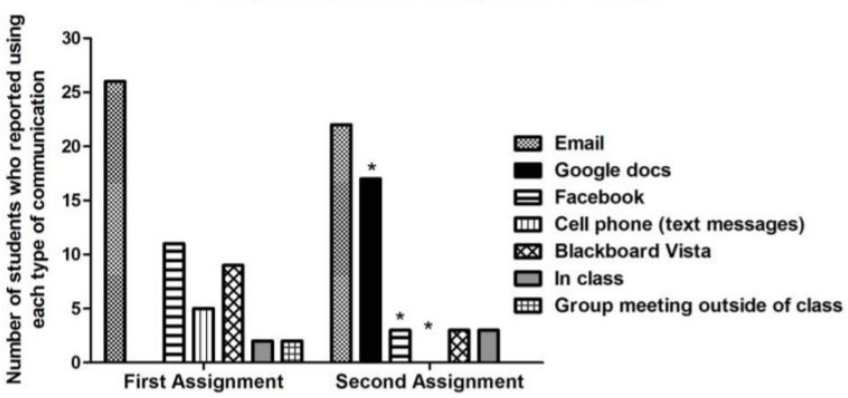

Figure 1: Means of communication during collaborative writing (Zhou, Wenyi)

Moreover, as seen in Figure 2 below, 36% of the students involved with this research found that the use of Google Docs made collaboration easier when compared to a more traditional medium.

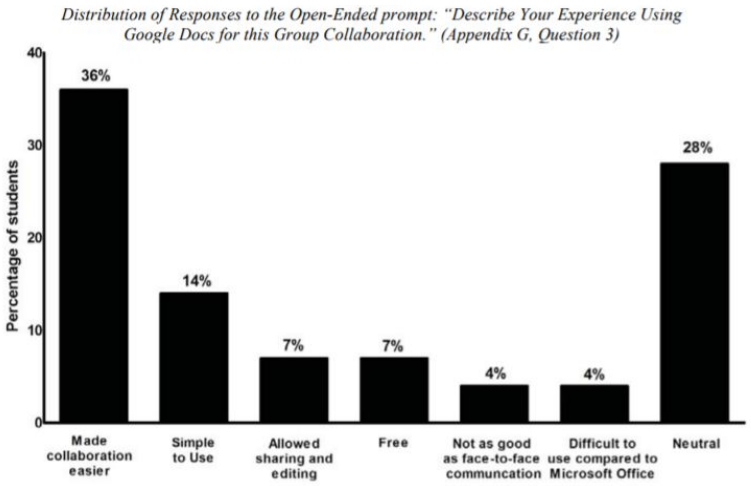

Figure 2: Distribution of Responses to the Open-Ended prompt: "Describe Your Experience Using Google Docs for this Group Collaboration." (Zhou, Wenyi)

In summary, the positive reaction of using Google Docs as a cloud platform among students revealed the merits of using cloud computing for out-of-class activities, in addition to traditional in-class assignments. According to Wenyi Zhou, "Today's students rarely meet face-to-face for group projects, but rather they find effective ways to collaborate through e-mails, instant messaging, video conferencing, and various web-based tools" (Zhou, Wenyi). I believe that these types of innovations and their applications have helped propel the advancement of online courses such as Lynda.com and Coursera.

Conclusion

Over the past several decades, obtaining an online education has become a more viable approach to learning a certain skill set, taking a course or even obtaining a degree because of the advancements in computer software and hardware. Improvements to a computer's hardware, such as the graphics card, CPU and RAM, set new standards to what we can do and accomplish on a computer. The computers today are able to display better graphics and more information. In addition, the processors function more quickly allowing a more efficient experience for the user. Software improvements to programming languages, such as Ruby on Rails, Javascript and CSS, define how one can utilize the hardware to create interactive and dynamic content on the web. Finally, the advent of cloud computing has revolutionized online education by allowing the teachers and students to interact in real time. Without these improvements the internet would have remained as solely a means to obtain information, rather than a dynamic tool for learning. I believe that online education will continue to develop further as new technologies become available such as Artificial Intelligence teaching software that perhaps is able to identify areas where students are deficient and focus on that content.

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