A New Learning Platform using E-textbooks for Socially Networked Online Learners

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Abstract: Conventional learning management systems that focus on traditional classrooms do not fit many-participant online courses such as massive open online courses (MOOCs). A learning platform, Creative Higher Education with Learning Objects (CHiLO) based on e-textbooks aims to develop a flexible learning environment for large-scale online courses. CHiLO essentially has high portability in electronic publication 3.0 (EPUB3) format as well as a comprehensive open network learning system using various existing technologies and learning resources, including open educational resources on open network communities, such as social networking service. We produced a series of CHiLO Books called "Nihongo Starter A1" in cooperation with the Open University of Japan (OUJ) and the Japan Foundation, and delivered them as a learning course of OUJ MOOC in Japan MOOC. Our set of experimental outcomes shows that CHiLO using not Web services but e-textbooks is available for large-scale online courses. The result reveals a positive completion rate of 22% and active participants posting at 25%.

1 INTRODUCTION

A traditional learning management system (LMS) is becoming outdated in large-scale online courses (Sclater, 2008) because LMS provides support for teaching and learning based on a conventional classroom although it is an educational support system at every level, for instance, managing learning outcomes, learning progress, and communication between learners. Therefore, a new LMS with different concepts is required for large-scale online courses (Mott, 2010).

Our learning platform, Creative Higher Education with Learning Objects (CHiLO) consists of components through e-textbooks developed with a totally new design, considering large-scale online courses such as massive open online courses (MOOCs). In this paper, we report the possibilities for CHiLO in our experiments on Japan massive open online courses (JMOOCs).

The basic outline of this paper is as follows: Section 2 provides a brief overview of the current pedagogical situation. Section 3 presents the architecture of CHiLO. Section 4 describes our experimental results. Section 5 discusses some challenges of CHiLO, and Section 6 is a summary.

2 PEDAGOGICAL SITUATION IN RECENT YEARS

2.1 Traditional LMSs

In the early 2000s, LMSs became widely used in higher education, along with the growth of the Internet (Cross, 2004). Following this generation, the LMSs we know today, e.g., Blackboard, Sakai, Moodle, and Canvas, appeared. The typical LMS comprises course creation and delivery, secure authentication and enrolment, content management and delivery, interaction between students, and

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methods of assessment and testing (see https://docs.moodle.org/27/en/Features).

Such traditional LMSs are designed as course-centric or time-based systems around content delivery, course delivery, and mechanics of running a course (Pitigala Liyanage, Lasith Gunawardena and Hirakawa, 2013). The course-centric system faces some challenges such as data analytics and relationship management for new online educational methods, including competency-based learning (Irakliotis and Johnstone, 2014). The conventional LMS focuses on a traditional classroom; it does not fit the new educational method. The course-centric system must be replaced with a learning-based or competency-based system that is completely aligned with students and what they need to progress educationally (Sturgis, 2011).

2.2 Current Pedagogical Situation

As recent online educational trends, learning content is split into smaller units, which are then reassembled to allow self-paced and self-path learning (Force, 2013).

2.2.1 Competency-based Education

Competency-based education (CBE) focuses on effective short-time learning for adult learners, for instance, working and self-supporting students, in a short amount of time.

The following points define competency-based learning approaches (Sturgis, 2011):

- Students advance upon mastery.
- Competencies include explicit, measurable, transferable learning objectives that empower students.
- Assessment is a meaningful, positive learning experience for students.
- Students receive timely, differentiated support on the basis of their individual learning needs.
- Learning outcomes emphasize competencies that include application and creation of knowledge, along with the development of important skills and dispositions.

Western Governors University (WGU) has used CBE since 1997 (Morrison and Mendenhall, 2001). In 2012, Southern New Hampshire University (SNHU), seeing a market opening for an LMS designed around CBE (Straumsheim, 2014), began advertising its program nationwide. In the United States, a number of community colleges provide CBE (Irakliotis and Johnstone, 2014).

At the same time, CBE is criticized in that colleges learn a great deal about their students' competence from grades and test scores but have no information about students' creativity and character (Grant, 2014).

2.2.2 Unbundling of Education

The Task Force on the Future of Massachusetts Institute of Technology (MIT) Education provided further insights into the unbundling of education, deemed to take different roles—such as classrooms, labs, and mentoring—as modules. A module is defined by its corresponding outcomes such as the instruction and assessment for the module. Each module is re-bundled with competency-based assessments or new assessment methods, which can relate directly to measurable outcomes for a class or module (Force, 2013). The Task Force considers small private online courses (SPOCS), on edX provided by MIT, to be nothing more than modules. The unbundling of education is an innovative method, and dozens of similar efforts are expected to appear across the United States in the next 3 to 5 years (Bull, 2013).

2.2.3 NanoDegree

The NanoDegree rendered by Udacity, a for-profit educational organization or a MOOC platform, provides learners with a bite-sized bundle of knowledge and immediate motivation for acquiring a degree. Furthermore, its curriculum is designed for acquiring specific business skills for 6–12 months (10–20 hours/week), for $200 a month. Traditional higher educational courses often do little to fill the gap between education and business. Instead, the evidence so far suggests that online education might do better in motivating low-income students, unable to invest time and money into liberal arts education, if a program relates directly to work. Companies might be best suited to shape such programs (Porter, 2014). However, the education favored by companies is also criticized for its lack of emphasis on liberal arts education (Belkin, 2014)

3 ARCHITECTURE OF CHILO

3.1 Implementation

An e-book has the advantage of being easily carried in some device such as a mobile phone or tablet PC, without a network. For learners, therefore, the e-book provides a study environment—anywhere, anytime.

An e-book standard format, EPUB, is the distribution and interchange format standard for digital publications and documents based on Web standards. EPUB defines a means of representing, packaging, and encoding structured and semantically enhanced Web content—including XHTML, CSS, SVG, images, and other resources—for distribution in a single-file format (see IDPF http://idpf.org/epub). EPUB can achieve economies of scale in design, development, and distribution (Belfanti, 2014).

The CHiLO, based on e-textbooks, aims to develop a flexible learning environment for large-scale online courses. It consists of the following four components:

- CHiLO Books using e-textbooks in EPUB3 format
- CHiLO Lectures based on one-minute nano lectures
- CHiLO Badges providing authentication and certification
- CHiLO Communities such as social networking services (SNS), bulletin boards, and chat rooms (Figure 1).

Figure 1: Implementation of four CHiLOs.

3.1.1 CHiLO Book and CHiLO Lecture

The core component of CHiLOs is CHiLO Books, which are created in EPUB3 format and have media-rich content including graphics, animation, audio, and embedded videos.

CHiLO Lectures comprise videos with scripts, quizzes, and other learning materials. Videos are one-minute nano lectures. This concept originated from an experiment showing that the viewing time of most online learners is approximately one minute.

A CHiLO Lecture is equivalent to one page in a traditional textbook. A CHiLO Book includes approximately 10 CHiLO Lectures and a link to a comment box allowing the user to post to Facebook. Furthermore, each page of the book has a link to quizzes on the material presented. A standard CHiLO course, comparable with a traditional university course with one academic credit, comprises 10 CHiLO Books.

3.1.2 CHiLO Badge

It is difficult to perform indirect assessments such as those on learning time and academic workload in large-scale online courses. Although CHiLOs adopted a direct assessment approach for learning outcomes, completion of a CHiLO course is measured in standard course hours corresponding to academic credits.

Whenever learners complete a CHiLO Book, they receive a CHiLO Badge, which is a simple mechanism of outcome assessment in CHiLOs. When tutors wish to check a learner's progress, they simply ask the learner to present the CHiLO Badge. They do not need to confirm with indirect assessment tools such as grade books, tracking of past results, and test scores. CHiLO Badges are based on open Mozilla badges.

3.1.3 CHiLO Communities

Learning communities called CHiLO Communities combine open SNS on the Web, such as Facebook and Twitter, with a forum of LMS. Learners ask questions, have discussions, and exchange information about their CHiLO Book.

In a large-scale community, a tutor is incapable of teaching many learners. A CHiLO Community consists of many learners and a few tutors called "connoisseurs" who act as substitutes for teachers. A learner who studies and completes CHiLO Books in a specific field can become a connoisseur. The connoisseur and learner stand on equal ground so that a connoisseur frequently exchanges information with learners in their communities.

In a CHiLO Community, learners do not learn from a tutor but on their own, with CHiLO Books as the learning materials. In this way, learners are constantly required to find suitable CHiLO Books in the community. The CHiLO Community provides functions of discovering, sharing, aggregating, and repurposing CHiLO Books for learners using Open Graph Protocol and Microdata.

4 RESULTS OF DEMONSTRATION EXPERIMENT

4.1 Experimental Methodology

We produced a series of CHiLO Books called "Nihongo Starter A1 (NS A1)" in cooperation with

the Open University of Japan (OUJ) and the Japan Foundation, and delivered them as a learning course of OUJ MOOC in JMOOC: JMOOC "is an organization that was formed in 2013 with the cooperation of Japanese universities and businesses that aims to spread and magnify Japanese MOOCs throughout the country" (see http://www.jmooc.jp/en/about/).

NS A1 comprises 10 e-textbooks for learners who want to study Japanese. A single package of an e-textbook is equivalent to one lesson. To improve operability and accessibility for learners, we developed and provided two types of CHiLO Books, one an EPUB version and the other a Web version. The Web versions were simply converted from the EPUB versions of CHiLO Books.

In the demonstration experiment, learners were allowed to download all the NS A1 CHiLO Books (10 books) from August 4 to October 15, and to participate in a learners group that was opened on Facebook. In other words, without any particular procedure of course registration, learners were free to download the CHiLO Books from the Internet and were able to learn at their own pace.

However, learners who participated in the Facebook group were recommended to study these 10 books according to a predetermined or standardized learning schedule, as shown in Table 1.

Table 1: Standardized Schedule.

Term	Learning Objective
1st week	Lessons 1 and 2
2nd week	Lessons 3 and 4
3rd week	Lessons 5 and 6
4th week	Lessons 7 and 8
5th week	Lessons 9 and 10
6th–10th week	Supplementary classes

4.2 Experimental Results

The learners who downloaded or browsed NS A1 CHiLO Books had access from the United States, Mexico, Colombia, Malaysia, Australia, Thailand, and Vietnam—in all 94 countries. Table 2 shows the number of people participating in the learners' activities.

Table 2: Numbers of People participating in Each Learner Activity.

Browsed at least 1 NS A1 CHiLO Book	2033
Participated in Facebook group	1491
Took at least one test	487
Were issued badges at least after one test	331

Figure 2 shows which type of format, EPUB3 or Web CHiLO Books, the learners selected for each lesson. For all the lessons, the Web format CHiLO Books were used by 3,624 learners and EPUB format CHiLO Books were used by 3,336 learners. Although the number of Web format users was slightly higher than that of EPUB3 format users, we assume that the difference is not significant.

As the level of the lessons advanced, however, the number of EPUB3 format users tended to exceed that of Web format users. In comparison, from Lesson 1 to Lesson 10, the number of Web format users increased by 14% and that of EPUB3 format users increased by 21%.

Furthermore, the fact that the total number of Web and EPUB format users for Lesson 1 exceeded "the number of people who have browsed at least 1 NS A1 CHiLO Book: 2,033" as shown in Table 2, suggests that some learners used both formats.

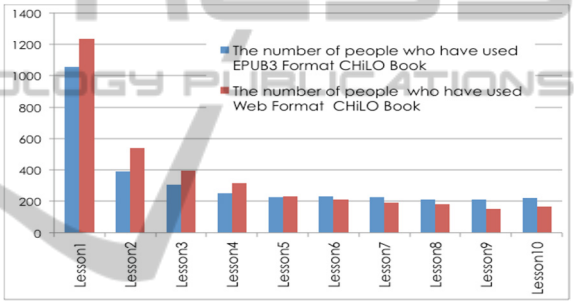

Figure 2: Number of learners who used EPUB3 format CHiLO Books or/and Web format CHiLO Books for each lesson.

Figure 3 shows the number of learners who had access to online exams from EPUB3 format CHiLO Books or/and Web format CHiLO Books for each lesson. For all the lessons, online exams were accessed by many more learners from Web format CHiLO Books than from EPUB format CHiLO Books.

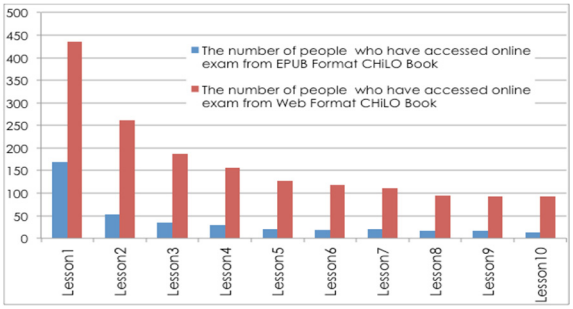

Figure 3: Number of learners who accessed online exams from EPUB3 format CHiLO Books or/and Web format CHiLO Books on each lesson.

Figure 4 shows specific activities of 1,491 learners who joined the Facebook group. Of the entire Facebook group, 336 learners, or over 20%, posted messages. Moreover, 329 learners posted certain comments responding to these messages, and 709 learners, or 40% of the participants in the Facebook group, sent Likes. Considering that only 1% of users post messages and only 9% post comments in general online communities (Nielsen, 2006), learners in this community were relatively active.

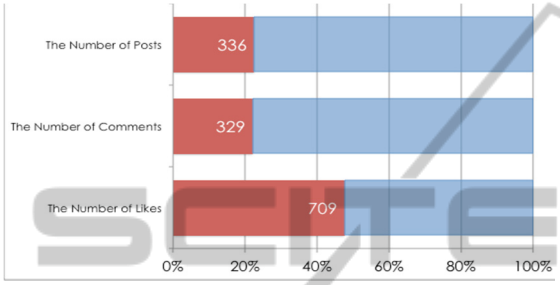

Figure 4: Activities of those who joined the Facebook group.

Figure 5 shows the number of learners who took online exams on each lesson and earned badges on those exams. Of learners who took an online exam on Lesson 1, 22% completed all 10 lessons and earned 10 badges.

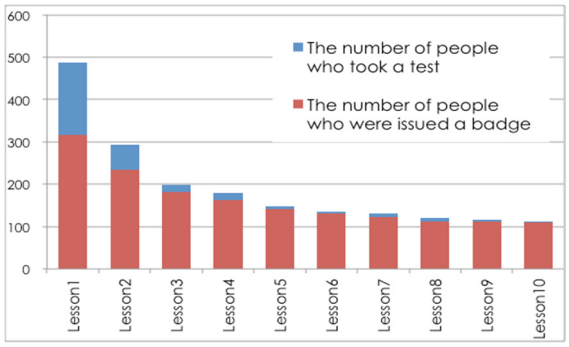

Figure 5: Number of learners who took online exams and earned badges on each lesson.

Figure 6 shows the time period when learners earned their first badges on Lesson 1. We divide the learners into two groups: "group completed," in which learners finished all 10 lessons and earned 10 badges, and "group uncompleted," in which learners could not finish the entire course despite earning one or more, but less than 10, badges. Additionally, we observed that learners in "group completed" earned their first badges earlier than those in "group uncompleted."

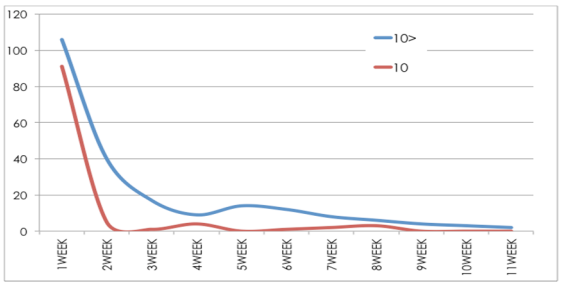

Figure 6: Time period when learners earned their first badges on Lesson 1.

Furthermore, we compared the two groups in terms of the time period for earning badges on each lesson. Figure 7, presenting the result for "group completed," shows that learners earned badges according to the recommended course schedule or earlier. On the other hand, the result for "group uncompleted" (Figure 8) shows that learners increasingly delayed the recommended course schedule for earning badges as the lessons progressed.

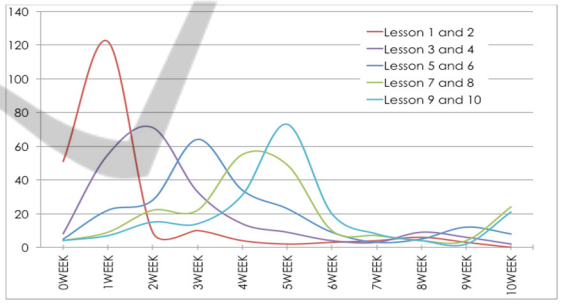

Figure 7: Time period for earning badges on each lesson in "group completed".

Concerning the time period in which learners completed the entire course and earned all 10 badges, Figure 9 shows that most learners in "group completed" completed the course within 5 weeks or according to the course schedule recommended. In contrast, the other learners took 1 to 10 weeks to complete the course.

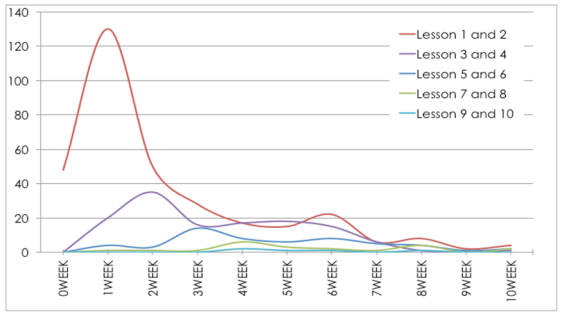

Figure 8: Time period for earning badges on each lesson in "group uncompleted".

5 DISCUSSION

5.1 Popularity of the Formats

As shown in Figure 2, the number of users of EPUB3 format CHiLO Books was almost the same as that of Web format CHiLO Books. However, the online exams were mainly accessed by the users of Web Format CHiLO Books, as indicated in Figure 3. This is presumably because a high percentage of learners had Internet connection at home and were familiar with using Web browsers on PCs. Another possible reason is that Web browsers are easier to use than e-book readers for online quizzes.

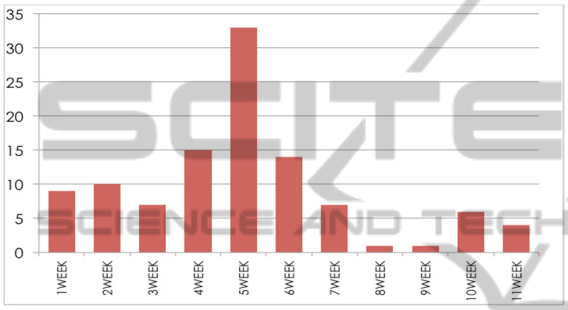

Figure 9: Time period in which learners completed the entire course.

Table 3: Which CHiLO Book did you use, the EPUB version or the Web version? (n = 92).

Mostly used Web version	48%	63%
Mainly Web version, sometimes eBook version	15%	
Used both EPUB version and Web version at the same rate	8%	37%
Mainly EPUB version, sometimes Web version	14%	
Mostly used the EPUB version	15%	

Table 4: Why did you use the EPUB version? (Check all that apply.).

Useful to have it downloaded to my device	32%
Wanted to use it in non-Internet-connected environment	30%
Interested in the book	16%
Wanted to use the functions within the eBook, such as bookmark, memo, etc.	9%
No specific reason	4%
Other	9%

According to the survey for learners who completed all lessons, on the other hand, 37% of the learners responded that they did use the EPUB Format CHiLO Books because they could take the e-books anywhere on their own devices and they could read them even offline (Tables 3 and 4). From now on, e-book-based learning will be more common and useful as an increasing number of people will tend to learn to use mobile devices. Additionally, highly accessible EPUB3 e-book readers must be used more widely for effective learning.

5.2 Learning Community

As indicated by the survey for those in the Facebook group who completed all lessons, the Facebook-based learning community was quite active (Tables 5 and 6).

Table 5: How often did you read the comments posted on Facebook? (n = 92).

Every day	34%
More than 1 day, less than 3 days a week	37%
More than 3 days, less than 7 days a week	21%
Less than 1 day a week	9%

Table 6: Were you satisfied with the activities on Facebook? (n = 92).

Very satisfied	45%
Somewhat satisfied	39%
Neither satisfied nor dissatisfied	14%
Somewhat dissatisfied	2%
Very dissatisfied	0%

There was a difference between learners in terms of pace and assignment completion because no explicit schedule for course enrollment or assignment submission was announced. Nevertheless, we observed that learning can occur where learners with the same objective gather.

The learning community observed here consisted of less than 1500 people—a small number compared to a typical MOOC learning community. If a larger number of people join the community, there will be difficulties in group activities; therefore, there will be some need to present an optimal grouping for learners on the basis of the analysis of learners' methods and objectives. This will be possible through development of CHiLO Analytics.

5.3 Scheduling of Learning

Although we did not set deadlines for learners, those who completed the course tended to progress according to the standard schedule we presented. On the other hand, only 30% of learners completed the course in 5 weeks, as defined in the standard schedule; the rest (70%) completed the course earlier or later. In a conventional online course, these

learners would likely think that the materials' levels were too low, or they would drop out, failing to complete the course by the deadline.

While there was no course as a learning framework, indication of a recommended learning schedule is an important factor for motivating learners to continue learning, and it is also effective to indicate the standard learning pace and learning path. We should also indicate that many learners who did not complete the course were delayed in progress on the lessons, compared with the standard schedule; this suggests that the standard schedule is not suitable for them. We should manage to provide learning schedules most suitable for individual learners by implementing CHiLO Analytics tools.

5.4 CHiLO Analytics, CHiLO Repository, and CHiLO Reader

We will launch a new component called the CHiLO Reader. The CHiLO Reader, an e-textbook reader, is easy to use while studying because it does not require switching to a browser and supporting media-rich functions. A Web format is currently available for CHiLO Books; however, using only an EPUB format that does not have to switch to the browser would be better.

The International Digital Publishing Forum (IDPF) has proposed the EDUPUB format to meet the requirements of next-generation learning content based on the e-book EPUB3 format (IDPF, 2014). However, at present, most e-book readers do not support the media-rich functions of the EDUPUB format, for example, embedding videos, JavaScript compliance, and JavaScript Object Notation (Figure 10).

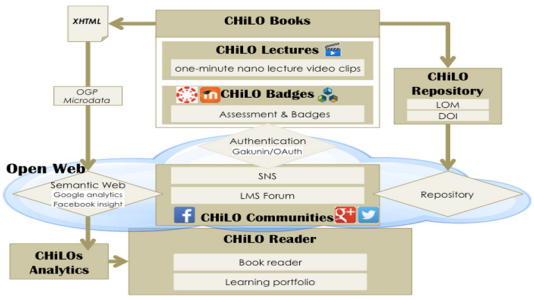

Figure 10: Developed CHiLO.

Additionally, Spanish-speaking learners volunteered to form a learning group in which they translated the NS A1 learning materials into Spanish. Although the CHiLO project has shown great development, several challenges persist. One is that the files used in the e-textbooks are too large to manage.

The embedded videos in CHiLO Books are small nano lecture video clips; however, each CHiLO Book typically includes a combination of graphics, video clips, online exams, and other components, which sometimes amount to over 200 files. Managing individual components and keeping all the parts up to date is a very complicated task. Additionally, there is no editing software to create e-textbooks; therefore, we had to code the sources from scratch. Thus, creating CHiLO Books takes a great deal of effort.

Finally, there is a need for an e-text reader that is easier to use for learning. A Web-based format is also available for CHiLO Books now, but it would be better to use only an EPUB-based format that does not require learners to switch to a Web browser when they need to access online resources.

6 CONCLUSIONS

In general, we obtained positive results in that 22% of learners who attempted the Lesson 1 examination completed their learning. The result is fairly good, considering that the typical completion rate in MOOCs is said to be less than 10%. However, rigid comparison is not possible because learners did not have to declare enrollment when they began learning in this pilot study.

Furthermore, we observed an interesting situation: a kind of mutual learning occurred in the learning community. Learners who had completed the course tended to provide helpful suggestions to learners following them.

REFERENCES

Belfanti, P. (2014). What is EDUPUB. Retrieved August 1, 2014, from http://www.imsglobal.org/edupub/WhatisEdupubBelfantiGylling.pdf.

Belkin, D. (2014). How to Sell a Liberal-Arts Education. *The Wall Street Journal.* Retrieved from: http://online.wsj.com/articles/how-a-college-president-sells-a-liberal-arts-education-1413751480?mod=rss_management.

Bull, B. (2013). Ongoing Unbundling of Higher Education and the MOOC University. *Etale - Life and Learning in the Digital World.* Retrieved from: http://etale.org/main/2013/08/27/ongoing-unbundling-of-higher-education-the-mooc-university/

Cross, J. (2004). An Informal History of eLearning. *On the Horizon, 12*(3), 103-110.

Force, M. T. (2013). Institute-wide Task Force on the Future of MIT Education: Preliminary Report. *Future of MIT Education. Last accessed, 17,* 02-14.

Grant, A. (2014). Throw Out the College Application System. *The New York Times Sunday Review.* Retrieved from: http://www.nytimes.com/2014/10/05/opinion/sunday/throw-out-the-college-application-system.html.

IDPF (2014). EPUB 3 EDUPUB Profile Draft Specification. *International Digital Publishing Forum.* Retrieved from: http://www.idpf.org/epub/profiles/edu/spec/

Irakliotis, L. and Johnstone, S. (2014). Competency-based Education Programs versus Traditional Data Management. *EDUCAUSE Review Online*. Retrieved from: http://www.educause.edu/ero/article/competency-based-education-programs-versus-traditional-data-management.

Morrison, J. L., and Mendenhall., R. W. (2001). Renaissance at Western Governors University: An Interview with Robert W. Mendenhall. *The Technology Source*. Retrieved March, 5, 2009.

Mott, J. (2010). Envisioning the Post-LMS Era: The Open Learning Network. *EDUCAUSE Quarterly*, 33(1), 1-9. Retrieved from: http://www.educause.edu/ero/article/envisioning-post-lms-era-open-learning-network.

Nielsen, J. (2006). The 90-9-1 Rule for Participation Inequality in Social Media and Online Communities. Retrieved from: http://www.nngroup.com/articles/participation-inequality/Pitigala Liyanage, M. P., Lasith Gunawardena, K. S., and Hirakawa, M. (2013). A framework for adaptive learning management systems using learning styles. *In Advances in ICT for Emerging Regions (ICTer), 2013 International Conference on* (pp. 261-265). IEEE.

Porter, E. (2014). A Smart Way to Skip College in Pursuit of a Job Udacity-ATandT 'NanoDegree' Offers an Entry-Level Approach to College. *The New York Times Economy.* Retrieved from: *http://www.nytimes.com/2014/06/18/business/economy/udacity-att-nanodegree-offers-an-entry-level-approach-to-college.html.*

Sclater, N. (2008). Web 2.0, Personal Learning Environments, and the Future of Learning Management Systems. *EDUCAUSE Center for Applied Research Research Bulletin*, 13(13), 1-13.

Straumsheim, C. (2014). Managing Competency-Based Learning, *Inside Higher Ed*. Retrieved from: https://www.insidehighered.com/news/2014/09/29/college-america-spins-its-custom-made-learning-management-system.

Sturgis, C., Patrick, S. and Pittenger, L. (2011). It's Not a Matter of Time: Highlights from the 2011 Competency-Based Learning Summit. *International Association for K-12 Online Learning.*