Developing an E-Book-Based Learning Platform Toward Higher Education for All

Masumi Hori[1(✉)], Seishi Ono[1], Kazutsuna Yamaji[2], Shinzo Kobayashi[3], Toshihiro Kita[4], and Tsuneo Yamada[5]

[1] NPO CCC-TIES, Nara, Japan
{hori, ono}@cccties.org
[2] Research and Development Centre for Academic Networks, National Institute of Informatics, Tokyo, Japan
yamaji@nii.ac.jp
[3] SmileNC & Co., Saitama, Japan
shinzo@smilenc.com
[4] Kumamoto University, Kumamoto, Japan
kita@ield.kumamoto-u.ac.jp
[5] Open University Japan, Chiba, Japan
tsyamada@ouj.ac.jp

Abstract. While higher education rapidly grows worldwide, regional differences widen the digital divide. Our Creative Higher Education with Learning Objects (CHiLO), an e-book-based learning platform, aims to provide opportunities in higher education for developing countries or rural areas that have restricted digital literacy, digital devices, learning resources, and quality of networks. CHiLO provides an adaptable learning environment corresponding to diversification and flexibility in online courses such as massive open online courses (MOOCs) using device-agnostic m-learning centered on e-books with media-rich content. CHiLO also aims at a comprehensive open network learning system through the use of various existing technologies and various learning resources, including OER on open network communities such as SNS. Our set of experimental outcomes demonstrates the efficacy of m-learning using CHiLO, particularly with an e-book, including media-rich content, nano lectures, and digital badges.

Keywords: EFA · ICT4D · Online course · E-Book · E-Learning

1 Introduction

With opportunities for diversified employment rapidly expanding globally, including in developing countries or rural areas in addition to advanced countries, many people hope for opportunities to obtain higher education in various forms. From 1991 to 2013, the gross enrollment ratio (GER) increased from 8.6 % to 22.8 % in South and West Asia, from 4.0 % to 8.2 % in Sub-Saharan Africa, and with the widening of regional gaps to 76.6 % in North America and Western Europe [1, 2].

Any conventional educational system that includes building a school, hiring a teacher, and equipping a classroom eventually will be unable to cope with rapidly

S. Zvacek et al. (Eds.): CSEDU 2015, CCIS 583, pp. 618–634, 2016.
DOI: 10.1007/978-3-319-29585-5_35

increasing demands for education [3]. In other words, a new education system, online education using information and communication technologies (ICTs) has many potentialities for higher education. Koller [4] described massive open online courses (MOOCs) that offer higher education opportunities, particularly for underprivileged communities, and alleviate the challenge of learning resource deficits, human and material, for rural areas.

However, in rural areas, there are low literacy rates and lack of technology-usage skills, high costs of accessing and owning ICTs, and acute shortages of electricity [6]; therefore, considerable cultural and physical differences exist between ICTs implementation and use in rural areas [5], and such differences prevent opportunities for higher education.

In rural areas, higher education opportunities for all require flexible and diversified learning environments that can resist unstable network infrastructure and unreliable power. We focused on recent trends of mobile devices' (smart phones and tablet PCs) rapid growth worldwide even in rural areas [7] to develop a new learning platform called Creative Higher Education with Learning Objects (CHiLO) that uses e-books compatible with many mobile devices not necessarily always connected to a network environment.

In this study, we report possibilities for CHiLO as a flexible and diversified learning platform through our experiment. The results provide evidence of the effectiveness of mobile devices with e-books.

2 Design Requirements for a Learning Platform

Information and communications technologies for development (ICT4D) aim to bridge ICTs and the digital divide (a gap due to socioeconomic underdevelopment) by ensuring equitable access to up-to-date communications technologies. An overview of the technology and processes of ICT4D consists of the following six components: infrastructure, hardware, software, interface, data, communication and processing (Fig. 1) [8]. These six components will also be useful for online learning platforms in rural areas.

2.1 Infrastructure and Hardware

Globally, approximately 60 % of people do not have Internet access [7]. Furthermore, 80 % of the world's people do not have a personal computer (PC) [9].

At the same time, mobile communication devices are so ubiquitously used in the world that "globally, mobile-broadband penetration will reach 32 % by the end of 2014—almost double the penetration rate just three years earlier (2011) and four times as high as that five years earlier (2009)" [7]. Mobile communication devices that provide satellite communication and a personal area network (PAN) such as bluetooth, a traditional telephone infrastructure, as well as Internet access are proliferating worldwide. In addition, these mobile communication devices do not depend only on the Internet. As Ally [10] stated, "It is true that many do not have desktop or laptop computers to access learning materials, but they have mobile devices and are now obtaining tablets with

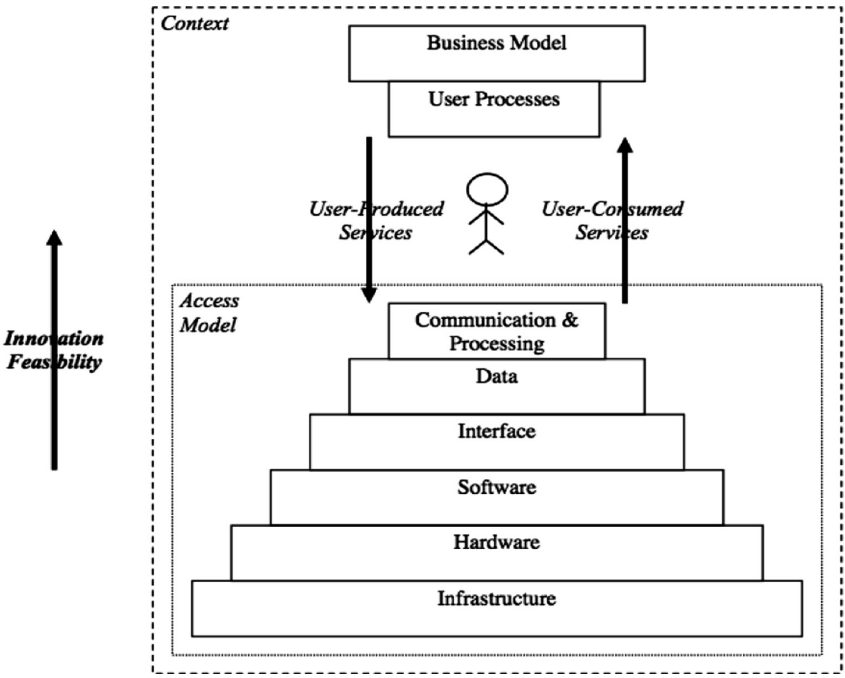

Fig. 1. Overview of the technology and processes of ICT4D [8].

wireless capability to allow them to access learning materials from anywhere and at any time."

Indeed, a project titled "Mobile Online Learning for Human Rights" was conducted in cooperation with the Kenya Human Rights Commission (KHRC). The primary goal was to create a platform to spread information freely about human rights to any Kenyan in order to increase knowledge and engagement. The research goals of this project were to explore the viability of using MOOC with incentives to reach, engage, and educate Kenyans. The course was free and open to anyone in Kenya; it offered both a digital badge and a certificate from Stockholm University in Sweden upon completion. Jobe and Hansson [11] asserted that "The current findings indicate that the availability of digital badges and certificates increased interest for participation and positively affected learning outcomes. Furthermore, the platform proved adequate for disseminating education in a developing country and allowed for unencumbered, ubiquitous access regardless of device."

A mobile ad-hoc network (MANET) is a network of mobile devices that are interconnected ad-hoc to share data. Data are shared in a multi-hop manner by being passed between devices, with each device having the potential to route data to another device in a mesh network. MANET is an effective approach to closing the digital divide in areas that do not possess reliable network connections such as the Internet [12].

The Digital Ubiquitous Mobile Broadband OLSR (DUMBO) project, initiated by the Asian Institute of Technology Internet Education and Research Laboratory, developed and tested a system for response to emergency scenarios in Thailand.

Adapting the concept of wireless mesh networks, DUMBO uses lightweight portable mobile nodes to broaden coverage and penetrate deep into areas not accessible by roads or where the telecommunication infrastructure has been destroyed [13]. Where the traditional wired infrastructure has been avoided because of prohibitive costs and unsympathetic geography, wireless technologies are attractive to governments, NGOs, and operators because they can be deployed in an inexpensive, decentralized, and effective manner in comparison with other solutions [12].

2.2 Interface

While the digital literacy of people in developing countries improves with each passing year [8], barriers such as low population density and remoteness, low levels of functional literacy, low disposable income, and constant struggle for survival still remain [14]. Although mobile devices are suited to online education in developing countries or rural areas [3, 8], devices with small screens, restrictive input methods, and limited battery life [15] leave some digital functions to be desired. For use in rural areas, a mobile device needs the special consideration of an excellent user interface.

2.3 Learning Resources

Online education in rural areas faces an acute shortage of learning resources such as content and materials, both in quality and quantity [3, 16–18]. Utilizing open educational resources (OERs) and MOOCs is the dominant approach to compensate for insufficiency, although there are problems in that part of MOOCs, which restrict translating and reprocessing work because of licensing, do not meet the need.

Another approach to reduce the shortage of learning resources is micro learning, for instance, competency-based education (CBE). CBE is designed to fit each learner: combined small and complete competency units are adapted to learners' competencies. Therefore, learning resources are available any time, and each competency unit is reusable [19]. The introduction of CBE enables the utilization of limited learning resources more effectively.

2.4 Communication and Processing

Many studies strongly suggest that cooperative learning is more effective than individual learning in contributing to motivation, raising achievement, and producing positive social outcomes [20]. Interactive learning using social networking services (SNS) such as Twitter, Facebook, and LinkedIn has dramatically developed cooperative learning [21, 22].

In rural areas, mobile devices have rapidly gained popularity. Mobile devices improve communication among social network members nationally and internationally, and they are increasingly changing the nature of knowledge in modern societies [8, 10, 18].

In addition, online classrooms using SNS through mobile devices solve the challenge of resource deficits, for example, teachers and educational materials; this can also be very effective in the brick-and-mortar classrooms of rural or impoverished areas [3].

3 E-Book and EDUPUB

An e-book has the advantage of being easily carried in some device—a mobile phone or tablet PC—without a network. Using e-books provides a new way of learning adapted to the network-learning model.

The e-book, which is not only device independent but also available off- or online, has adopted m-learning. Furthermore, e-books have the interoperability of EPUB and major e-book formats, namely Kindle's K8 format, iBook's .iBooks format, and others [23]. EPUB3 is a distribution and interchange format standard for e-books, developed by the International Digital Publishing Forum (IDPF) [24].

With the advent of the EPUB3 format, e-books now include media-rich and interactive contents. IDPF 2015 defines this capability as follows: "The EPUB specification is a distribution and interchange format standard for digital publications and documents. EPUB defines a means of representing, packaging, and encoding structured and semantically enhanced Web content—including HTML5, CSS, SVG, images, and other resources—for distribution in a single-file format." Thus, the EPUB3 format has greater sourcing flexibility. In the education field, learning materials in the EPUB3 format are easily repurposed by tutors, adapted to improve learning outcomes, and offer a way of avoiding vendor lock-in [26].

IDPF has proposed the EDUPUB format to meet requirements of next-generation learning content on the basis of the e-book EPUB3 format [25]. EDUPUB implemented a system for cooperation with the Learning Management System (LMS), the Analytics System, the Student Information System (SIS), and the assessment system on EPUB3 using JavaScript and JavaScript Object Notation (JSON) (Fig. 2).

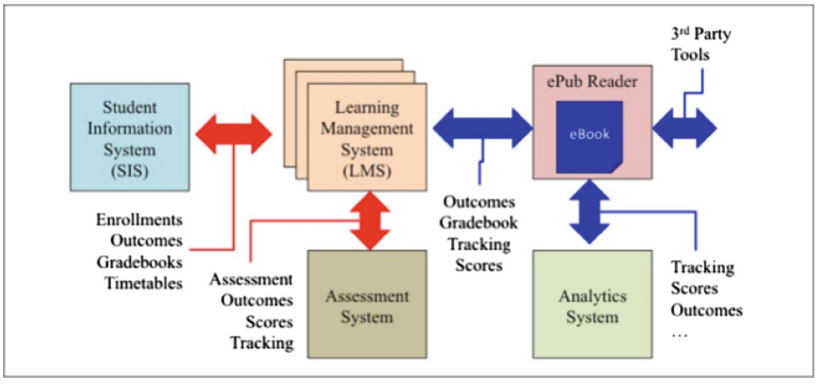

Fig. 2. Overarching EDUPUB architectural model [25].

Smith and Kukulska-Hulme [27] reported the following on results of an 18-month project (2010–12) led by the Institute of Educational Technology (IET) at the Open University, United Kingdom:

1. E-books on portable devices are appropriate for the lifestyle needs of distance-education students.
2. When available, Internet access only enables timely downloading and use. "Situational reading" occurs when one or more books with the desired content are accessible to learners when needed, thus matching readers' requirements in relation to their current situation.
3. An e-book can contain in one package all the resources needed by a student.

E-books are now being introduced into education, and their improvement has been widely studied. EDUPUB is one of the elegant solutions. However, the implementation of these applications is still being discussed. Furthermore, EUPUB is not necessarily focused on use in rural areas.

4 CHiLO Framework

E-books suit an application of IT-driven education systems in rural areas with poor networks. For implementing a flexible learning environment in rural areas, our CHiLO incorporates the EPUB3 format for e-books and consists of four components as follows (Fig. 3):

- CHiLO Book using e-books in the EPUB3 format
- CHiLO Lecture based on one-minute nano lecture

Fig. 3. Implementation of four CHiLOs.

- CHiLO Badge providing authentication and certification
- CHiLO Community such as SNS, bulletin boards, and chat rooms

4.1 CHiLO Book

The core component of CHiLO, created through an e-book with an EPUB3 format, contains media-rich contents, including graphics, animation, audio, and embedded video. The CHiLO Book based on CBE consists of learning materials for a classroom hour. Those who complete a CHiLO Book receive a CHiLO Badge as a certificate of completion.

Another idea for online education involves the use of e-books by EDUPUB. However, most e-book readers do not currently support the media-rich functions of the EDUPUB format, such as embedded videos, JavaScript compliance, and JSON. One reader that does support JSON is Readium, which is an open-source EPUB reader developed by IDPF. One of Readium's disadvantages is that it currently does not support mobile devices such as smartphones and tablets. The CHiLO Book offers a realistic solution by combining an e-book reader and a Web browser. The EPUB3-based CHiLO Book ensures access to a learning environment anytime, anywhere, even without Internet connection, thereby avoiding the difficulties of most e-books. The CHiLO Book as an e-book is also available in e-book stores, for instance, the iTunes Store and Google Play Books. Another potential disadvantage of an e-book is that it requires a special application such as an e-book reader and must be downloaded into the e-book reader. Learners without this access will need to use the Web-based CHiLO Book.

4.2 CHiLO Lecture

CHiLO Lecture comprises a video with scripts, some quizzes, and other learning materials. The video is a one-minute nano lecture. This concept originated from an experiment showing that the viewing time of most online learners is approximately one minute [28].

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.

4.3 CHiLO Badge

In online courses, performing indirect assessments such as those on learning time and academic workload is difficult. Although CHiLO adopted a direct assessment approach for learning outcomes, the 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 CHiLO. 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 gradebooks, tracking past results, and test scores. Badges increase motivation, and different types of badges can affect learning performance [29].

4.4 CHiLO Community

A learning community called CHiLO Community combines an 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 Books.

In a CHiLO 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 Book 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 Book as the learning materials. Thus, learners are constantly required to find suitable CHiLO Books in the community.

5 Applying the CHiLO Framework for MOOC

5.1 Methodology

We produced a series of CHiLO Books called "Nihongo Starter A1 (NSA1)" in cooperation with the Open University of Japan (OUJ) and the Japan Foundation. We 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" (http://www.jmooc.jp/en/about/).

NSA1 comprises 10 e-books for learners who want to study Japanese. A single package of an e-book is equivalent to one lesson.

The NSA1 series' functions of assignment tests and issuing badges were implemented by linking Moodle modules of quizzes and badges. Both the formats included hyperlinks to Facebook groups, which were created as the "CHiLO community" and were opened for learners and teachers.

As a demonstration experiment, we distributed CHiLO Books of the NSA1 series in approximately one year (from April 2014 to March 2015), at no charge, through the three different distribution channels shown in Table 1. Among these distribution channels, the OUJ-MOOC site is one of the platforms supported by JMOOC, which is an MOOC provider in Japan (http://www.jmooc.jp/en/about/).

Table 2 shows the start and end dates and terms in which each class (Class 1–Class 5) was held as a CHiLO community. In each community/class and term, our staff members

Table 1. Distribution channels.

Distribution channels	EPUB3-based	Web-based
OUJ-MOOC site	√	√
iBooks Store (Apple Store)	√	N/A
Google Play Books	√	N/A

Table 2. Learning communities as CHiLO communities.

	Start	End	Term
Class 1	4/14/2014	5/1/2014	35 days
Class 2	6/2/2014	7/6/2014	35 days
Class 3	8/4/2014	10/15/2014	73 days
Class 4	11/3/2014	12/21/2014	49 days
Class 5	1/12/2015	3/22/2015	70 days

in the support team for NSA1 facilitated discussions and question-and-answer sessions among the community.

5.2 Results

A. Number of downloads of CHiLO Books

Table 3 shows the number of downloaded NSA1 CHiLO Books by country and region. Although there were legal restrictions in some countries and regions on downloading EPUB3-based CHiLO Books in the iBooks Store and Google Play Books, in this demonstration experiment, we found that CHiLO Books had been downloaded in 109

Table 3. Number of downloads of NSA1 CHiLO Books.

Countries and regions	Total	Google play	IBooks Store	OUJ-MOOC
United States	3,625	1,214	1,844	567
Indonesia	2,022	1,578	0	444
Japan	1,833	488	701	644
Thailand	1,384	1,308	0	76
Philippines	1,201	826	0	375
Mexico	710	88	164	458
Malaysia	690	541	0	149
Colombia	678	14	31	633
Venezuela	532	16	11	505
Brazil	499	183	69	247
Others (99)	8,954	2,114	895	5,945
Total (109)	22,128	8,370	3,715	10,043

countries and regions: Google Play Books in 45 countries, iBooks Store in 34 countries, and OUJ-MOOC in 109 countries and regions. Particularly, CHiLO Books were frequently downloaded in rural areas: Indonesia (2,022), Thailand (1,833), Philippines (1,201), Mexico (710), Malaysia (690), Colombia (678), Venezuela (532), and Brazil (499). This results show that the CHiLO Book and these format appeals to people in rural areas.

B. Device use

Questionnaire results from those who earned badges in this demonstration experiment (n = 105) are as follows (Table 4):

Table 4. Questionnaire results: Which CHiLO Book did you use: EPUB3-based or Web-based CHiLO Book? (n = 105).

Mostly used the eBook version	17	50.5 %
Mainly the eBook version, sometimes the Web version	13	
Used both the eBook version and the Web version at the same rate	6	
Mainly the Web version, sometimes the eBook version	17	
Mostly used the Web version	52	49.5 %

- In total, 91.4 % (96) of the respondents learned with the CHiLO Books at home.
- In total, 79.0 % (83) of the respondents primarily used PCs.
- In total, 50.5 % (53) of the respondents used the EPUB3-based CHiLO Books in some way.

With regard to the analysis of device-specific access to the Moodle quiz module, 56.1 % (1,771) accessed from PCs, 18.1 % (572) from tablet PCs, and 25.8 % (831) from smartphones (Fig. 4).

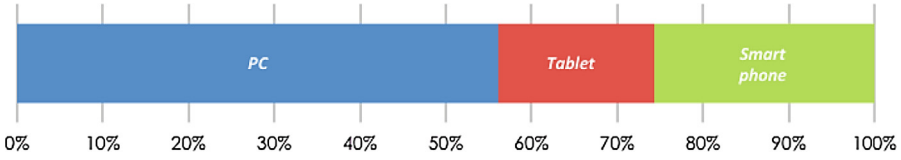

Fig. 4. Ratio of traffic of quizzes in each CHiLO Book by device.

Furthermore, we divided access logs into EPUB3-based and Web-based CHiLO Books; in the case of Web-based books, approximately 69 % of accesses were from PCs; in the case of EPUB3-based books, approximately 73 % accessed from mobile devices such as smartphones and tablet PCs (Fig. 5).

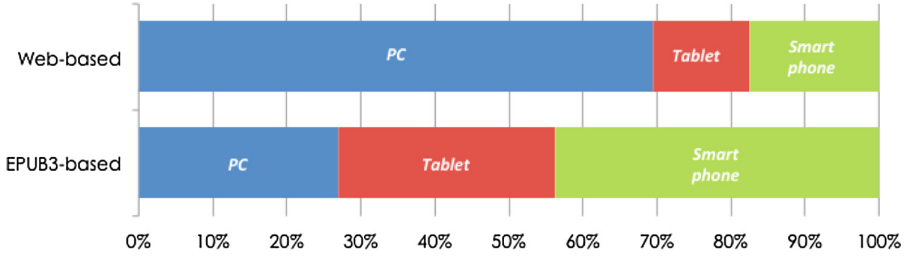

Fig. 5. Ratio of people who responded to the questionnaire by the CHiLO Book format and devices.

C.
Learning Community

Learners can access the distribution channels shown in Table 1 at any time and from any location. In the CHiLO community, to increase the desire to learn, we continued to post messages to notify participants of the assigned CHiLO Book and showed a standardized learning schedule each week.

Table 5 shows that participants of each class (Class 1–Class 5) acquired all 10 badges of the 10-volume CHiLO Books.

Table 5. Participated in Facebook group and earned all 10 badges.

	Participated in Facebook group	Issued all 10 badges
Class 1	448	2
Class 2	852	7
Class 3	1491	105
Class 4	287	26
Class 5	103	14

Figure 6 shows the number of badges issued daily over 1 year.

The number of badges issued tended to be high in terms of each class (Class 1–Class 5).

Table 6. Standardized schedule for class 3.

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

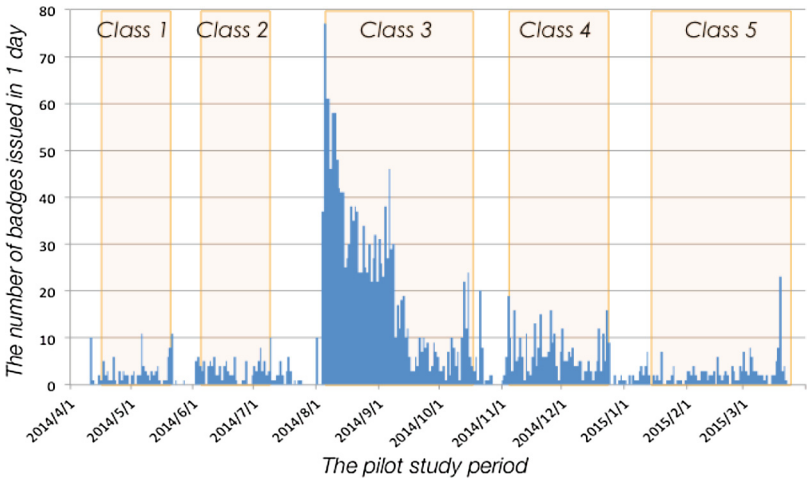

Fig. 6. Daily number of badges issued over 1 year.

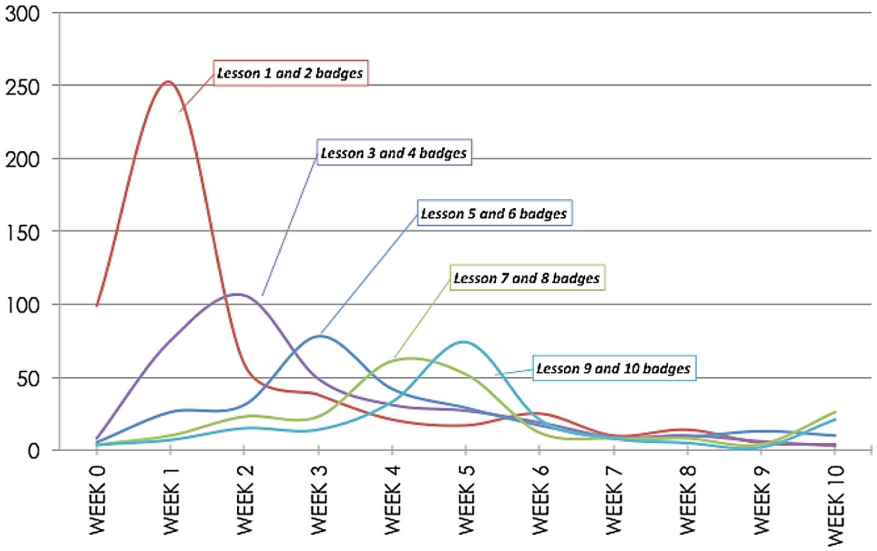

Fig. 7. Time period for earning badges on each lesson.

Table 6 shows the standardized schedule of Class 3. Figure 7 shows the badge acquisition status during the schedule of Table 6. Learners attempted to acquire badges before beginning the supplementary classes, prompted by our notification.

Figure 8 shows 1,491 participants who joined Class 3. Of 1,491 participants, 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

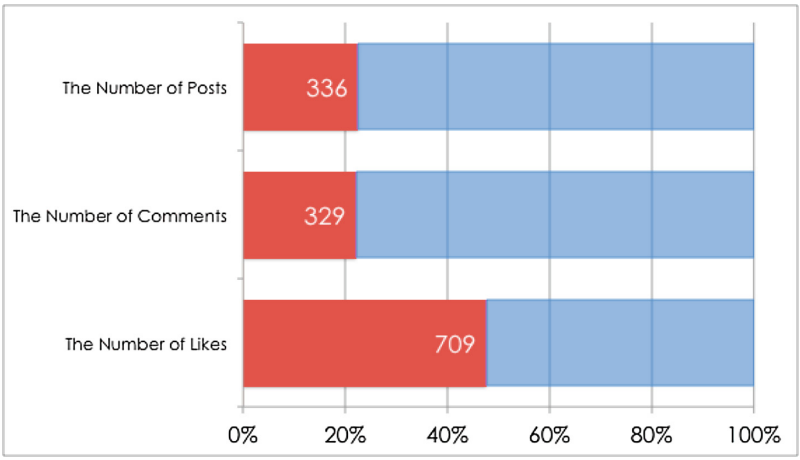

Fig. 8. Activities of those who joined the facebook group.

and only 9 % post comments in general online communities [30], learners in this community were relatively active.

6 Discussion

6.1 Evaluation

From results of the demonstration experiment, we believe that the CHiLO system has three advantages.

First, CHiLO can offer flexible formats, wherein we can provide learning content to people in different countries. Although CHiLO Books were unfamiliar to most people who participated in the experiment, we successfully delivered our books to a large number of people, including those in rural areas.

Second, while we did not appeal to learners to choose either the Web-based or the EPUB3-based CHiLO Book in this demonstration experiment, some learners responded to our questionnaire as follows: "I used both types depending on where I was and how long I had. I used the EPUB3 type to review the contents when I was in the office or elsewhere and the Web type when I was at home and could work more peacefully."

Presumably, learners in this demonstration experiment tended to switch devices effectively depending on their Internet connection; they would learn through Web-based CHiLO Books on PCs when they had access to the Internet at home or at school. In contrast, they would download EPUB3-based CHiLO Books and learn the contents on their own mobile devices such as smartphones or tablet PCs when they did not have Internet access. CHiLO can potentially provide a device-independent and ubiquitous learning environment in which learners select Web-based or EPUB3-based CHiLO Books according to their preferences.

Finally, a type of mutual learning occurred in the learning community. While the badge-earning rate in this experiment was not very high, many participants posted in

the learning community that they were happy with the community and showed off the badges they had achieved. Participants who had completed the series tended to provide helpful suggestions to participants following them. In addition, Spanish-speaking learners volunteered to form a learning group in which they translated the CHiLO Books into Spanish. Learners who had completed the course tended to provide helpful suggestions to learners following them.

6.2 Issues

An issue in the demonstration experiment is that learners did not completely enjoy the merits of EPUB3-based CHiLO Books.

Some learners reported as follows:

1. Videos embedded in EPUB3-based CHiLO could not be played.
2. Assessment examinations embedded in EPUB3-based CHiLO could not be connected.
3. EPUB3-based CHiLO Books were not successfully downloaded.

In the first case, despite the embedded videos meeting specifications of EPUB3, many existing e-book readers on EPUB3 do not support embedded videos. In a later investigation, an e-book reader, which had not been recommended, did not work as expected with embedded videos.

In the second case, a learner can read the CHiLO Book without a network connection but can take assessment examinations only with a network connection. Consequently, the learning environment becomes somewhat complex.

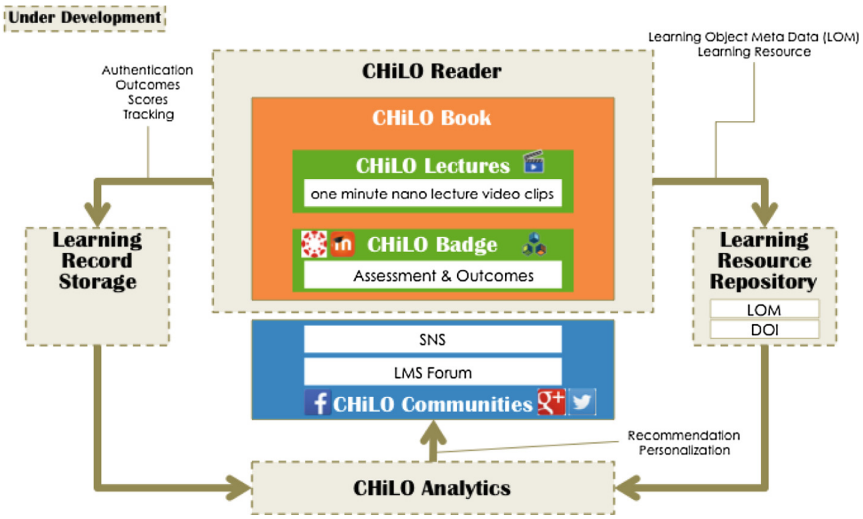

Fig. 9. CHiLO Book architecture.

In the third case, the file size of a CHiLO Book is 20 Mbytes at the maximum, and that is not a large size in a constant-connection network. Even so, this size imposed strict limits in some regions.

7 Conclusions and Future Work

With regard to geographical digital divide issues, CHiLO offered affordable formats for people in 109 countries and regions, including developing countries and/or rural areas. In addition, the learners selected Web-based or EPUB3-based CHiLO Books on PCs or smartphones according to their preferences and lifestyles. These results demonstrate that CHiLO can provide flexible, diverse learning environments that are also device independent, network independent, and anytime and anywhere.

These results reveal that CHiLO has plenty of potential for mobile learning in limited network environments; thus, CHiLO resolves these physical problems in rural areas. At the same time, CHiLO including CHiLO Book, which provides a user interface similar to that of an e-book wherein readers can literally flip a page without any difficulty, resolves cultural problems, such as the challenge of digital illiteracy.

However, CHiLO has some challenges such as the issue of some existing e-book readers. To reduce those problems, we will soon release a dedicated e-book reader for CHiLO Book to enhance the usability of CHiLO Book called CHiLO Reader. The CHiLO Reader is compliant with EPUB3, with embedded video, JavaScript, and JSON data. This enables the development of all embedded-type CHiLO Book that contains assessment examinations and a digital badge-issuing feature. It is possible to enjoy learning activities without an Internet connection, such as viewing a video lecture and resulting in earning a badge. The CHiLO Reader also has the feature of recording learning history (outcomes, scores, tracking, and others) in defect of connecting networks. Once it is connected to the Internet, those records send the history to the Learning Record Storage (Fig. 9).

To use CHiLO in a restricted network environment is another challenge. We attempted to implement MANET in the CHiLO Reader. Thus, each learner of the CHiLO Reader can build an ad-hoc network, with each device having the potential to route data to another device in a mesh network.

References

1. Varghese, N.V.: Globalization, economic crisis and national strategies for higher education development. In: International Institute for Educational Planning (IIEP) Research Paper, UNESCO. Paris: IIEP (2009)
2. UNESCO EFA: Education for all 2000–2015: achievements and challenges (2015)
3. Usha, R.V.R.: Primer 1: An introduction to ICT for development. Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT). Chapter 3. ICTD Applications in Core Sectors of Development, pp. 81–109 (2011)
4. Koller, D.: What we're learning from online education (2012). http://www.ted.com/talks/daphne_koller_what_we_re_learning_from_online_education. Accessed 17 August 2015

5. Heeks, R.: Information systems and developing countries: failure, success, and local improvisations. Inf. Soc. **18**(2), 101–112 (2002)
6. Asiimwe, E.N., Wakabi, W., Grönlund, Å.: Using technology for enhancing transparency and accountability in low resource communities: experiences from Uganda. In: ICT for Anti-Corruption, Democracy and Education in East Africa, vol. 37, pp. 37−51 (2013)
7. ITU: The World in 2014: ICT facts and figures (2014). https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf. Accessed 17 August 2015
8. Heeks, R.: The ICT4D 2.0 Manifesto: where next for ICTs and international development?, Manchester Centre for Development Informatics, Development Informatics Working Paper Series (2009)
9. The World Bank: Mobile phone access reaches three quarters of planet's population (2012). http://www.worldbank.org/en/news/press-release/2012/07/17/mobile-phone-access-reaches-three-quarters-planets-population. Accessed 17 August 2015
10. Ally, M., Samaka, M.: Open education resources and mobile technology to narrow the learning divide. Int. Rev. Res. Open Distrib. Learn. **14**(2), 14–27 (2013)
11. Jobe, W., Hansson, P.: Mobile learning for human rights in Kenya: the Haki Zangu case for non-formal learning. In: ICT for Anti-Corruption, Democracy and Education in East Africa, p. 67 (2013)
12. Stan, K.: New & emergent ICTs and climate change in developing countries. Center for Development Informatics. Institute for Development Policy and Managment, SED. University of Manchester (2011)
13. Kanchanasut, K., Tunpan, A., Awal, M.A., et al.: DUMBONET: a multimedia communication system for collaborative emergency response operations in disaster-affected areas. Int. J. Emerg. Manag. **4**(4), 670–681 (2007)
14. Bhavnani, A., Chiu, R.W.W., Janakiram, S., et al.: The Role of Mobile Phones in Sustainable Rural Poverty Reduction. World Bank Global Information and Communications Department, Washington (2008)
15. Parsons, D., Ryu, H., Cranshaw, M.: A design requirements framework for mobile learning environments. J. Comput. **2**(4), 1–8 (2007)
16. Marais, M.: Analysis of the factors affecting the sustainability of ICT4D initiatives (2011)
17. Colle, R.: Building ICT4D capacity in and by African universities. Int. J. Edu. Develop. Using ICT **1**(1), 101–107 (2005)
18. Smith, M.L.: Being Open in ICT4D. SSRN (2014)
19. Johnstone, S.M., Soares, L.: Principles for developing competency-based education programs. Change: Mag. High. Learn. **46**(2), 12–19 (2014)
20. Chen, B., Bryer, T.: Investigating instructional strategies for using social media in formal and informal learning. Int. Rev. Res. Open Distrib. Learn. **13**, 87–104 (2012)
21. Siemens, G.: Connectivism: Learning as network-creation (2005). http://www.elearnspace.org/Articles/networks.htm
22. Downes, S.: An introduction to connective knowledge (2005). http://www.downes.ca/post/33034. Accessed 17 August 2015
23. Bläsi, C., Franz, R.: On the interoperability of eBook formats. Report for European Booksellers Federation and International Booksellers Federation presented to the EU Commissioner for the Digital Agenda (2013)
24. Polanka, S.: What Librarians Need to Know About EPUB3 (2013). http://corescholar.libraries.wright.edu/ul_pub/159/. Accessed 17 August 2015
25. IDPF: EPUB 3 EDUPUB Profile Draft Specification (2015). http://www.idpf.org/epub/profiles/edu/spec/. Accessed 17 August 2015
26. Belfanti, P.: What is EDUPUB (2014). http://www.imsglobal.org/edupub/WhatisEdupubBelfantiGylling.pdf. Accessed 1 August 2014

27. Smith, M., Kukulska-Hulme, A.: Building m-learning capacity in higher education: E-books and iPads. In: Specht, M., Multisilta, J., Sharples, M., (eds.) World Conference on Mobile and Contextual Learning Proceedings. Helsinki: CELSTEC & CICERO Learning, pp. 298–301 (2012)
28. Hori, M., Ono, S., Kobayashi, S., Yamaji, K. et al.: Peer-to-peer Learning on Large Scale Online Courses: Focusing on Lurkers. In: 6th International Conference on e-Learning and Innovative Pedagogies (2013)
29. Abramovich, S., Schunn, C., Higashi, R.M.: Are badges useful in education?: it depends upon the type of badge and expertise of learner. Edu. Tech. Res. Dev. **61**(2), 217–232 (2013)
30. Nielsen, J.: The 90-9-1 Rule for Participation Inequality in Social Media and Online Communities (2006). http://www.nngroup.com/articles/participation-inequality/Pitigala. Accessed 17 August 2015