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Developing Information Technology in OpenCourseWare: From Movements to Opportunities in Asia

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ABSTRACT

This paper aims to summarize and analyze the Developing Information Technology in Open CourseWare (OCW) movements and new opportunities in Asia in the context of supporting the education process in higher education that is in accordance with the recent demands for graduate competency supported by IT innovation. The review method is carried out in 3 stages: searching and downloading articles, filtering and sorting, and final screening. The results of this review show that the OCW movement in Asia is growing rapidly, among others, due to IT innovation, stakeholder commitment, public awareness, and the need for quality teaching materials. In the era of web 5.0 technology, lecturers must have the competencies to develop electronic activities through the Web that make students truly active so that online learning actually takes place rather than the electronic reading process. The impact of IT innovation has brought drastic changes in the field of education in the learning process has become an effective driving tool for improving learning outcomes and achieving educational goals, one of the most recent innovations is OCW. OCW movement in Asia has progressed rapidly and significantly, although they experience transformations in accordance with technological developments and needs in the field.

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1. INTRODUCTION

Information technology (IT) has brought drastic changes in the field of education (Rohmah & Rachmawati, 2019). The application of IT innovation in the learning process has become an effective driving tool for improving learning outcomes and achieving educational goals as the function of IT in the field of education can be used various functions in the education system and processes from management and processes, such as recruitment of new students, curriculum development, conducting lectures, measuring student performance (Amelia *et al.*, 2019) monitor and process student and teacher attendance data through the camera in real time in the form of image processing for example (Prasetyo, 2017), so that this makes it easier for managers to manage their academics data, the increasing role played by IT can be more positive. One example is equitable access to education throughout the world with these technologies. Teachers can improve teaching skills and easily get teaching materials, while students can increase their interest and learning abilities. The form of ease of access to learning materials is the online lecturing process or Open Courseware (OCW) where the use of web technology is in providing and disseminating learning materials online and can be accessed without knowing the time and place.

The rapid development of information and communication technology has encouraged open and free education movement around the world (Abelson, 2008) is known in various countries as open education (which includes open resources, tools, and practices and shared frameworks to improve education access and effectiveness throughout the world). The movements (Elias *et al.*, 2016; Johansen & Wiley, 2011) have encouraged the realization of equal rights to achieve quality education for all people (Rohs & Ganz, 2015). OCW enables lecture materials to be accessed freely and without any cost (Barrett *et al.*, 2009). The term OCW (Wiley *et al.*, 2014) was first adopted by UNESCO in 2002 in the "Forum on the Impact of Open Coursework for Higher Education in Developing Countries" (Clements, Pawlowski, & Manouselis, 2015)(Rodríguez *et al.*, 2017). OCW is a collection of materials published online through a website; for example, lecture notes, reading lists, recitals, syllabi, teaching materials and exam questions, illustrations and simulations, and streaming videos of preparatory classes, published since 2002 through IT in the form of websites or portals (Sheu & Shih, 2017) with non-commercial purposes (Karunanayaka & Naidu, 2018). OCW is an innovative breakthrough for improving the quality of learning, teaching materials, and teaching in higher education, as well as providing alternative choices of materials for students to independently study necessary subjects outside the regular classes. The OCW project provides high-quality and well-designed learning materials by experts in their fields, so students can learn according to their abilities and needs (Rhoads *et al.*, 2013).

The basic principle of OCW is that knowledge is a human product that can be distributed freely and used for various purposes for all levels of society in the world, including persons with disabilities (Elias *et al.*, 2016; Johansen & Wiley, 2011; Guo *et al.*, 2015). Although OCW was said to be initiated in 1999 (Abelson, 2008) in Germany when the University of Tubingen published certain lecture videos, it was formally introduced first by the Massachusetts Institute of Technology (MIT) in 2001 (Abelson, 2008; Barrett *et al.*, 2009). One of the characters of OCW is the ability for self-funding and to facilitate higher education institutions to share the knowledge produced (Johansen & Wiley, 2011). The concept of OCW can be used as an alternative in providing and improving distance education services in the world, especially in developing countries,

because the materials have been widely translated into shared languages in the world, which certainly makes it easy to adopt. In 2003 the MIT OCW Project released 500 lectures with the website address of https://ocw.mit.edu/index.htm (Friesen & Murray, 2013; Ros *et al.*, 2014; Morris, 2011).

OCW is growing rapidly in the world due to the establishment of the Open Education Consortium (OEC) supported by The Hewlett Foundation (Wiley *et al.*, 2014; Rodríguez *et al.*, 2017; Sheu & Shih, 2017). OEC is a network of members of non-profit education institutions and organizations. OEC represents its members and provides advocacy and leadership around advancement of education that is open globally. OEC works with its members to build the capacity (Karunanayaka & Naidu, 2018) to find, reuse, create, and share, known as the concept of OERs; develop open policies; create models of open and sustainable education; and enable international collaboration and innovation. OEC annually coordinates and organizes Open Education Week, Global Open Education Conference, and Open Education Award for Excellence. Collectively, these efforts aim to bring high-quality and inclusive education to all students throughout the world.

OCW Consortium is an initiative of a leading university in the United States and the world, namely MIT (Massachusetts Institute of Technology). MIT, through its president director, decided to freely distribute all their lecture materials through the Internet in various forms, including learning modules, exam questions, projects, assignments, lectures, e-books, and multimedia such as streaming and online forms in collaborative environments. This concept basically facilitates access for users to interact with one another; for example, forming study groups or establishing communication with lecturers and professors. This platform is generally called OCW, which is an interactive and web-based application. Furthermore, this program is supported by various universities in the world as joint hosts, namely U-Mass Boston and Tufts University.

It has been continuously developed and utilized throughout the world, including in Indonesia. At present, the OCW collection has reached more than 2,000 types of businesses with more than 300 GB content volume and continued to grow every day. OCW cannot be separated from OERs (Ros *et al.*, 2014) because most OCW materials are open or part of OERs and open-licensed documents and media useful for teaching, learning, education, assessment, and research. In other words, OERs refer to all types of educational materials in the public domain or introduced with open publishing licenses (Saripudin *et al.*, 2018).

This review aims to help stakeholders in the field of education, especially open education, to understand the conditions of the OCW movements in Asia and to manage challenges and find the best solutions in the future for the quality of education globally and in Asia specifically by taking advantage of the advanced development in information and communication technology.

OCW poses a challenge for education practitioners, not only in terms of material creation but also on how to distribute the materials. Today, OCW is progressing along with the development of web 2.0 technology (Rhoads *et al.*, 2013; Saripudin *et al.*, 2018; Friesen & Murray, 2013; Ros *et al.*, 2014), web 3.0, web 4.0 and web 5.0 (Morris, 2011; Rho & Chen, 2016; Benito-Osorio *et al.*, 2013), based on **Figure 1** we can see the evolution of the World Wide Web has a big role in driving the rapid development and growth of OCW.

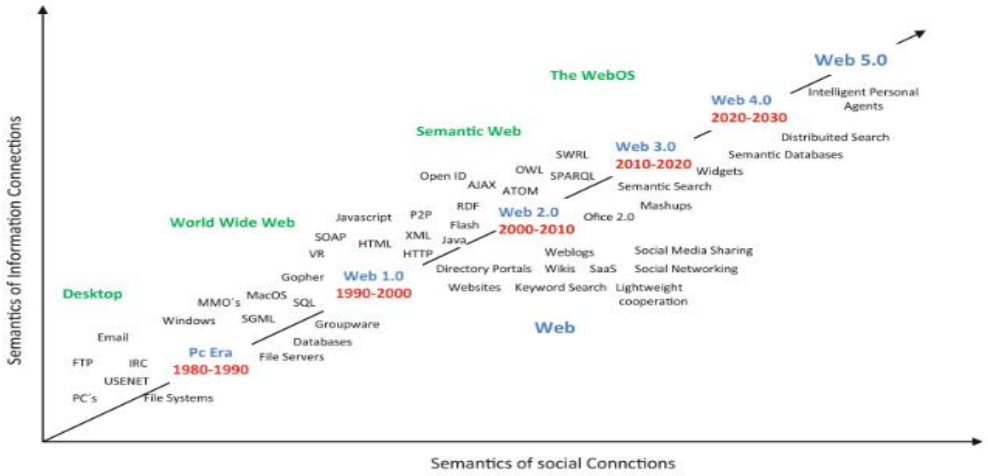

Figure 1. Evolution of World Wide Web. Source Own elaboration based on radar networks (Benito-Osorio et al., 2013).

OCW cannot be separated from the movement of OERs as an impact of the awareness of knowledge sharing and its massive movement. Eventually, students have more choices than before and can learn independently. Today, there are more and more web portals organizing OCW, which are no longer limited to universities. Private non-college companies also have initiated their support, such as Google with its YouTube application (Bissell, 2009) and LinkedIn Corporation with its slideshare application which provides support in the form of hosting services for professional content, including presentations, infographics, documents and videos. Users can upload files privately or publicly in PowerPoint, Word, PDF or OpenDocument format. Content can then be viewed on the site itself, on handheld devices, or embedded in other sites (Hilton *et al.,* 2010; Bissell, 2009). There is also Apple corporation with its iTunes software applications that can play, organize, and buy songs (from the iTunes Store), which can also be used to manage contents on iPod, iPhone, iPod Touch, and iPad. IOS users use iTunes to download applications from the App Store. This software is available in a version that can be run using the Mac OS X, Windows 2000, XP, and Vista operating systems. The previous iTunes version can also be run in Mac OS 9 even if Apple does not provide access to it anymore. This device has gained a reputation for its ease to use and good song organization (Ros *et al.,* 2014; Alevizou, 2015; Hilton *et al.,* 2010).

Recent OCW research trends have led to the expansion of equal rights to education, improving the quality of education and the distribution of quality learning materials (Rohs & Ganz, 2015). Keeping up with this trend is research on the Massive Open Online Courses (MOOCs) which was begun and has been developed since 2014 (Alevizou, 2015). MOOCs is a form of online lectures in a massive collaboration among thousands of participants who can participate at the same time. The lecture is assisted by one or many experts ready to help by providing lecture materials in various formats, interacting for a period of time, and giving lectures on topics of various issues according to their field of expertise. Slightly different from OCW, MOOCs concept does not offer a credit system or fees for each course completed by students, but the results of course assessment can be used in applying for certain professional certificates. Lectures are carried out using web-based ICT technology; everyone is free to enter and leave the class. One more difference is

that in OCW there are no classes, interactions between students and instructors, peer-to-peer discussions, and question and answer activities (Tovar *et al.*, 2013). Many world-renowned universities offer lectures with this concept for free, such as Coursera, edX, and Udacity. In Asia, there are three large MOOCs platforms: Udacity, Coursera, and edX, with 21.4% of online and open-access course students from all over the world joining this program, and the highest number (35.2%) came from North America (Rambe & Moeti, 2017).

This review has three main objectives. First is reviewing the extent of the development of OCW in Asia. Five countries were selected through literature review as a sample, representing homogeneity and able to describe the condition of higher education in Asia in general. These countries are Japan, China, South Korea, India, and Indonesia. Second is analyzing the challenges of OCW in Asia. The third is providing advice and input for the development of OCW in Asia based on the results of the review on several selected journal articles.

The review is aimed to summarizing and analysing the Developing Information Technology in Open CourseWare movement, new challenges, and opportunities in Asia in supporting the process of education in higher education that is in accordance with the current demands of the competency of its graduates. This review is limited to Asia because currently the continent has more open universities with an increasing number of students taking distant learning than any other region in the world. Hence, Asia is quite representative to describe how OCW was initiated and currently developing (Jung & Latchem, 2007).

2. METHODS

The focus of this study is limited to the development analyze the Developing Information Technology in OCW, implementation, adoption, and challenges, and opportunities for OCW in Asia. As shown in **Figure 2**, the review was carried out in 3 stages: article search and downloading, filtering and sorting, and final screening. Articles that meet the criteria were then: 1) taken and summarized based on title, abstract, method and basic findings; 2) Filtered and sorted by topic, and 3) Synthesized in accordance with the research objectives.

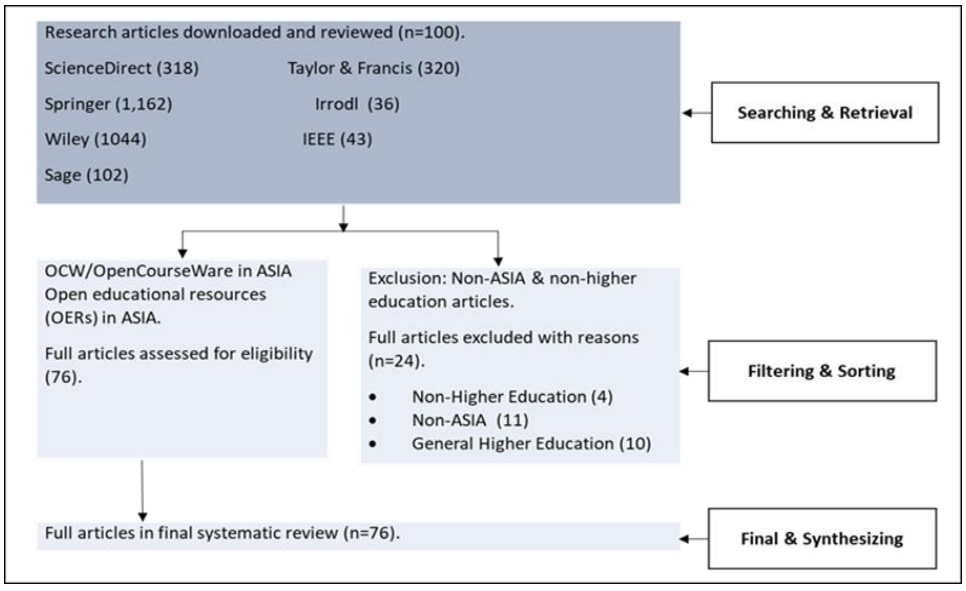

Figure 2. Flow diagram of the process of finding and filtering references.

2.1. Procedure for Searching and Collecting Articles.

The search for research articles published in journals is needed to look for references in the review process. The study was conducted from July 2018 to April 2019. The portal sources for research article databases used as references include ScienceDirect, Taylor and Francis, Wiley electronic database, Springer, IEEE, irrodl, and Sage. The following keywords were used to obtain research articles from the databases mentioned: OCW/Open CourseWare in ASIA and OERs in ASIA. Searched articles are written in English to facilitate understanding and availability of articles. Articles published in the period 2009 to 2019 were downloaded and combined into one folder. Related references cited by selected articles were also considered and downloaded. The article search applied the snowball sampling technique. The cumulative number of publications in various electronic databases displayed in searching on April 2019, is in detail: ScienceDirect (n = 318), Taylor and Francis (n = 320), Wiley (n = 1044), Springer (n = 1,162), IEEE (n = 43), Sage (n = 102) and (irrodl (n = 36).

2.2. Data Sorting Procedure.

A total of 100 articles were taken and reviewed based on title, abstract, method, and basic findings. They were tabulated based on the following criteria:

1. Author and year of publication,
2. Participants,
3. Context,
4. Research Design and Instruments, and
5. Basic Findings.

3. RESULTS

In general, the articles reviewed show that the OCW movement in Asia has progressed rapidly and significantly, although they experience transformations in accordance with technological developments and needs in the field.. Detail description of the OCW movement in Asian countries, especially in the five selected countries, is provided as follow.

3.1. OCW Movement in India

The OCW movement in India can be said to be quite advanced in line with the government's encouragement and public awareness, among others, by announcing the availability of learning resources on the Internet from three instrumental national-level organizations, namely Indira Gandhi National Open University (IGNOU), National Board of Educational Research and Training (NCERT), and the Indian Institute of Technology (IIT). Currently in India more than 250 institutions organize and provide OCW, with most of these institutions utilizing the CMS (course management system) application to run their OCW (Chakravarty & Kaur, 2008; Ghosh & Kumar Das, 2007). India has launched e-content initiatives and national curriculum since 2009, which has spurred the creation, adaptation, and use of OERs and driven a focus on fast content production and acquisition, with an initial focus on technical education, science and technology, and medicine, including public health (Kumar, 2009).

Indian higher education is constrained by a number of challenges such as poor teacher quality, infrastructure, libraries, and educational resources. To anticipate this, the Indian government has initiated several innovative programs and schemes such as SHAKSHAT, NMEICT, NPTEL, OSCAR, E -grid etc., related to developing and disseminating educational resources (Kumar, 2009).

3.2. OCW Movement in Japan

In Japan, 1,500 lecture materials have been provided by universities participating in the Japanese OCW Consortium, where 1,285 were written in Japanese and 212 of them in English (Hammer, 2013). At the beginning of this movement, around 2006, there were six major universities that had the initiative to launch the OCW website (Ito, 2008). To date, the Japanese OCW Con-

sortium has included ten universities (Stracke, 2017). One ideal example of the success of OCW utilization can be seen at the United Nations University (UNU) which was established in 1973 (Barrett *et al.*, 2009; Aoki, 2010). Currently in Japan e-learning courseware has been used in various universities to help improve students' English skills (Saripudin *et al.*, 2018).

3.3. OCW Movement in China

The OCW movement in China is quite rapid (Guo *et al.*, 2015; Hu *et al.*, 2015; Lee *et al.*, 2007). For example, in Taiwan there is Opensource OCW Prototype System (OOPS), formed by an organization consisting of volunteers (Lee *et al.*, 2007), headquartered in Taiwan. It was originally designed to translate open source materials from the MIT OCW site into Chinese (Sheu & Shih, 2017). The success of the CW movement in China is largely due to initiatives from the Chinese government who provide special incentives for developers of lecture materials to be distributed openly. In 2008, the China Quality OCW program scheme has made more than 1,600 lecture methods available for free access.

Since 2003, the Government of China has established and implemented a program called the "Chinese Quality Course" (Guo *et al.*, 2015). In the same year, MIT translated English lecture materials into Chinese in collaboration with CORE and Open Source projects in Taiwan. Judging from these developments, it can be said that the OCW in China is growing very rapidly (Guo *et al.*, 2015).

3.4. OCW Movement in South Korea

Korea is one of the countries in Asia that has the best information technology infrastructure and the best internet speed in the world. Currently, Korea is one of the countries involved in the movement of e-science and cyberscience, or cyberinfrastructure, which is growing rapidly in developed countries in the world (Stracke, 2017). Korea is one of the most productive countries producing OERs materials since 2007. The Korean OCW has until now produced more than 140,000 lecture materials (Hakim, 2017).

Currently Korea's e-readiness is better than that of Japan (Guo *et al.*, 2015). As with other countries in the world, South Korea also led a movement of translating the materials into Korean language. Korea has participated in the consortium movement since 2008, and its e-readiness is now better than that of Japan. In fact, Korea's National Open University is now offering postgraduate e-learning programs, and until recently as many as 17 cyber universities have been established in Korea (Jung & Latchem, 2007).

3.5. OCW Movement in Indonesia

Indonesia's commitment to the OCW movement is shown by evidence that the country is one of those adopting the Paris agreement. Indonesia is one of the few Asian countries that have supported, developed, and implemented OERs (Shelton *et al.*, 2010). The Indonesian government sent its representatives from the Ministry of Education and Culture to attend the 2012 World OERs Congress and adopted the Declaration. Other evidence for the government's strong support for the OCW movement is the stipulation of the 2012 Higher Education Law Number 12 in article 79 paragraph 4, which is further emphasized through Minister of Education and Culture Regulation No. 109 of 2013 concerning Implementation of Distance Education in Higher Education, stating that one of the scopes of distance education is at the level of course.

At present, the Open University, which is one of the universities given the task by the government of the Republic of Indonesia (Finkelstein, 2012) to hold open courses, has developed more than 500 OER-based modules in the forms of audio-visual, graphics, and Adobe Systems (Hakim, 2017). In 2007, Indonesia established the Indonesian Higher

Education Network (INHERENT), whose main goal is to facilitate the sharing of educational and research resources, where the development of resources is based on the principles of open source and open access. INHERENT also serves as a national repository for publications.

In 2014 the Government of Indonesia, through the Directorate of Learning and Student Affairs, Directorate General of Higher Education, Ministry of Education, established the Indonesian Integrated Open and Online Learning (PDITT). This platform is connected to the "Rumah Belajar" (Learning House) portal. The program was launched by Vice President Boediono on October 15, 2014. On September 18, 2016, the platform was transformed into *Sistem Pembelajaran Daring* or Online Learning System (SPADA). One of the objectives of SPADA is to improve equitable access to quality learning in Higher Education. Although still in its growth period, SPADA establishment marks the Indonesian government's efforts to expand opportunities to provide higher education through a system similar to MOOCs and OCW. Five universities were involved in its development: University of Indonesia (UI), Bandung Institute of Technology (ITB), Gadjah Mada University (UGM), Sepuluh November Institute of Surabaya, and Bina Nusantara University. In order to facilitate, simplify, and widen access to quality OCW content, the website ocw.mit.edu is mirrored, to also save time and money on the use of internet networks (Smith & Casserly, 2006). Now Indonesian SPADA has collaborated with 51 organizing colleges and continued to grow.

Indonesia, like other developing countries in the Asian region is currently transforming into an OER-based education system. Similar initiatives have been introduced in other regions such as Brazil, China, Korea, Slovenia, South Africa, Turkey, and Vietnam (James & Bossu, 2014). In 2011, Prof. Dr. Eko Indrajit and colleagues along with the Ministry of Higher Education conducted research on 350 universities in Indonesia to map and examine problems related to the application of the concept of open education.

4. DISCUSSION

In the era of web 5.0 technology, lecturers must have the competencies needed to develop electronic activities through the Web that make students truly active so that online learning actually takes place rather than the electronic reading process that runs as usual where the lecturer merely abstracts learning material and sources of material that has been created, while students only switch media from conventional to digital forms (Benito-Osorio *et al.*, 2013).

The transition process is not only transferring media through conventional forms into digital form but also how a lecturer can provide further motivation so students are interested, has an initiative and is active in the learning process. If this is done well by the lecturer, it is optimistic that it can anticipate the loss of interaction and motivation between students and lecturers because students feel involved and fully bound to succeed in the learning process in accordance with the specified curriculum objectives.

Through the concept of 5.0 web-based learning, lecturers need to be given training in the use of ICT not only on how to use hardware and software but also on how teachers can change from traditional teaching-centered systems to systems based on critical thinking.

There are serious problems that occur in developing countries in Asia such as Indonesia; one of which is that there are still digital gaps, especially for teachers, this is, of course, a separate challenge that must be overcome through various ways by involving all relevant stakeholders. However, a study by Sheu and Shih (2017) statistically shows the successful use of OCW at National Taiwan University, specifically for the lecture materials which are overall designed for

Chinese users who live in urban areas, where information and communication technology is more developed. The research concludes that accessibility needs to be continuously developed. The same can be done in other countries in the Asian region, especially in the provision of supplementary content translated into languages commonly used as a lecturing/medium of instruction in that country to facilitate and improve the accessibility of its users.

A study by Hajri *et al.* (2017) reported that there has been a significant increase in OER content indexed by the W3C. This situation certainly illustrates that the movement of open content is very promising and has continued to develop well, but it needs to be supported by all experts and stakeholders in each field (Morris, 2011).

Indonesia with the Indonesian government's SPADA network through the ministry of research and technology provides incentives through the Indonesian Online Learning System (SPADA) grant scheme for each subject, especially for courses that can be implemented through online systems. With the requirements, among others, comes from study programs that have been accredited at least B and administered by permanent lecturers (not extraordinary lecturers). This can arouse the enthusiasm of the teaching staff to be able to compete in entering competent and competitive lecture material so that in the end it can enrich SPADA content with quality lecture content. SPADA has been held by 54 universities, with partner universities as many as 2012 and with a total of 18,138 students enrolled, there are also available services, including 297 open contents, 221 open courses, and 279 online courses. Measurement and evaluation is needed for each lecture material that has been uploaded so that the quality of each material can be maintained and matched its purpose.

This systematic review has identified several gaps. First, there were only three articles that discuss the role of the curriculum in the implementation of OCW from the beginning of the planning to implementation and evaluation of online lecture processes. Meanwhile, the role of curriculum cannot be ignored, as it plays a crucial role both in the quality of material developed, achievement of objectives and goals of the materials, and the success of the online lectures. The open nature of OCW requires users' awareness and independence to use the curriculum as a guide in their learning. To take as an example, the OCW portal managed by MIT provides an online curriculum to be used as a guide for the portal users.

The second gap is no empirical article found focusing on the IT literacy gap of OCW users, whereas IT literacy is really necessary in supporting the success of each user in attending online lectures. Future research must consider the possible impact of IT literacy gap on the success of online lectures.

Of the one hundred articles selected and studied comprehensively and in depth, none was concerned with how to develop lecture materials that fit for all. Technological development trends, availability of infrastructure, and easy accessibility should ideally be directly aligned with increased production and access to OCW content. Learning models using OCW materials require the user to have the principle of life-long learning.

Looking at the trends of technological developments, infrastructure availability and easy accessibility should ideally be aligned with increased production and access to OCW contents. The learning model utilizing OCW material requires a person who holds the principle of lifelong learning (Castaño Muñoz *et al.,* 2013). Learners should also be aware that they will be learning without any external support or force. This condition certainly creates challenges for OCW creators or developers to create and develop material that interests their learners.

5. CONCLUSION

Previous empirical studies discussed in great extent the impact of open education and open content, emphasizing the positive impact on equitable access to quality education. Method from Shelton *et al.* (2010) can be used as a tool to help make it easier and more effective for users to search the content of lecture materials based on OCW and OERs. In general, the articles reviewed in this study indicate that the OCW movements through Developing Information Technology and the formation of consortiums have succeeded and developed rapidly. This is partly due to, among others, technological advancement and increased need and awareness of open and equal distribution of education for all. The condition has encouraged OCW to transform from its original form into SPOCs and MOOCs. Although MOOCs is growing rapidly, effective MOOC models for each level of education and subject matter should be further developed. Open education and open content are important; however, the impact of the loss of conventional classroom should also be taken into account. In the online classroom, there is less social interaction, and sometimes there is none. This condition is certainly not good, considering the nature of humans as social beings, who relate reciprocally with other humans. Now, the interaction is replaced by technology intermediaries. The flourishing of open education and content certainly has both positive and negative consequences that need to be further studied.

6. AUTHORS' NOTE

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article. Authors confirmed that the data and the paper are free of plagiarism.

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