

## **Open Educational Resources: A Literature Review**

MAIMOONA AL ABRI

NADA DABBAGH

*George Mason University*

*The open educational resources (OER) movement is an emerging trend in higher education contexts, primarily due to the ubiquitous use of technology and access to the internet. This literature review focuses on the concept of OER, its essential definitions, its potential benefits, its open nature, and various aspects of adoption. The research findings indicate that the OER movement has not expanded fully into educational sectors, and the level of faculty and student awareness is quite low. The research also reveals that the current status of OER adoption in educational sectors is minimal. Additionally, OER adoption has encountered several obstacles; potential users have difficulty finding the proper OER materials, and there are quality control issues with resources. However, students saved a significant amount of money when OER replaced traditional textbooks. Many critical issues related to OER adoption must be resolved, and others may arise as more faculty and students begin to use these resources.*

*Keywords:* higher education, open educational resources, , OER, perceptions of OER, K-12, technology adoption, open pedagogy, teaching and learning

### **INTRODUCTION**

Open educational resources (OER) is a relatively new phenomenon in the education sector that intends to increase the quality of education and democratize the access of knowledge without restrictions (William and Flora Hewlett Foundation, 2013). Examples of OER projects used in education since its emergence are the UK Open University (UKOU) and Athabasca University (AU). The UKOU, launched in 20016, was the first successful initiative in the OER

movement launched (Conole, 2015). It customized an open source learning management system to develop an OpenLearn online repository for OER initiatives (Mikroyannidis, 2011). OpenLearn consists of two learning areas: LearningSpace and LabSpace (Mikroyannidis, 2011). LearningSpace organizes OER as independent learning modules and integrates with social networking technologies to provide a collaborative environment for group work. LabSpace allows users to practice OER activities by publishing content, repurposing materials, and re-mixing existing resources. In addition, Athabasca University (AU) is a good illustration of open access initiatives in Canadian higher education. Also established in 2006, AU is considered as the 'First OER University' that launched (McGreal, Anderson, & Conrad, 2015). The policy of AU states that all publications that are developed by the university faculty must be stored in the university repository. OER collections in the repository include scholarly publications and open access textbooks (McGreal et al., 2015).

The importance of OER in education is anchored in its essence to eliminate the concern about the nature of ownership and to validate knowledge that are available as public goods (Ehlers, 2011). In addition, the concept of OER raises the awareness of sharing knowledge with everyone and offer them privileges to reuse and repurpose these open resources to meet specific needs (Wiley, Bliss, & McEwen, 2014). The essence behind OER is not merely to further move the OER movement forward, but also to cut down on the cost of higher education, to improve teaching and learning experiences, to increase the sustainability of OER adoption, to encourage formal and lifelong learning, and to promote personalized learning (William and Flora Hewlett Foundation, 2013). Yin and Fan (2011) stated that OER development must keep improving through the collaborative network of organizations, institutions, and educators in order to ensure the continuous improvement of OER materials and enhance its quality. Because the OER movement is still emerging, its impact on the education sector needs to be explored. The purpose of this paper is to gain an in-depth understanding of the concept of OER and explore its applications and implications in education sectors. In this paper, we present various definitions of OER and provide a brief background of open educational resources and the legal permissions for using OER. Subsequently, we present a review of the literature on OER that examines the potential benefits of OER from different perspectives and preliminary research into OER adoption in education. We end with conclusions and future research implications.

### OPEN EDUCATIONAL RESOURCES OVERVIEW

Since the emergence of OER, different definitions have been proposed by various organizations and OER experts, reflecting their perspectives about the essence of OER. However, there is general agreement on the definition of OER developed by the Hewlett Foundation:

Open Educational Resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and repurposing by others. OER include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (William and Flora Hewlett Foundation, n.d., para. 7).

Furthermore, in a meeting held with the support of the Hewlett Foundation where the term OER was coined, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2002) described the main properties of OER as the free accessible materials promoted by information and communication technologies for non-commercial objectives. While these definitions are most common, others expand and make more explicit what OER includes. Pawlowski and Bick (2012) defined OER as “freely accessible resources for educational purposes” that include a variety of the artifacts and types of OER (p. 209). For example, *learning objects* such as multimedia content, simulations, and website resources, and *conventional materials* such as articles, textbooks, and digital materials, which are freely available and called ‘open access’ fall within this definition of OER. In addition, Pawlowski and Bick include *software tools* such as Linux and Moodle, which are customizable learning tools that promote communication and collaboration, *instructional experiences* which are developed by instructors and teachers to achieve efficient and successful learning experiences such as lesson plans and case studies, and *curricula* including the methods of sharing experience about teaching and instructional materials among educators, as examples of OER. Finally, in Pawlowski and Bick’s definition, they refer to *assets*, which are objects that cannot stand alone in learning contexts, such as images, text, and external links which can be obtained through

search engines as OER. Taken together, these definitions suggest that OER has been harnessed for educational purposes regardless of the type of content.

Finally, a further definition of OER is given by David Wiley (n.d.) who describes OER as educational content and learning resources that are subject to Creative Commons (CC) licenses. Creative Commons licenses allow users to access materials in the public domain for free without having to obtain copyright and usage permissions by practicing the 5R Framework. Wiley (n.d.) explains that the 5R Framework is based on five permissions: (a) *retain* the original work and control copies of the content such as download and duplicate, (b) *reuse* the materials exactly as they are; (c) *revise* content by adapting, modifying, improving, and changing such as translating into different languages; (d) *remix* original content by incorporating it with other material to produce new content; and (e) *redistribute* the revised and mixed original copies among educators or friends (para. 1). For the purposes of this paper, OER is defined as any educational resources that reside in the public domain or are subject to CC licenses that grant users permission to practice the 5R Framework. In summary, the concept of OER as resources that are accessible, free, and open for educators' use without licensing costs incorporates the authorization and licenses that facilitate and control the 5R Framework.

### **Background of OER**

The rapid development in technology and widespread availability of the Internet led to the emergence of several open practices in education (e.g., open education) (Blackall, 2007; Yang & Kinshuk, 2017) including, online learning, e-learning, and distance education. The open education movement improved access to high-quality learning and resources to global masses at a lower cost than traditional, face-to-face education and contributes to empowering instructors' capabilities, through sharing and building upon their pedagogical innovations (Organization for Economic Co-Operation and Development, 2007; Biswas-Diener & Jhangiani, 2017). Caswell, Henson, Jensen, and Wiley (2008) traced the roots of the open education movement to the free software movement, which precludes the emergence of OER.

The emergence of OER goes back to 1985, when the Free Software Foundation was founded by Richard Stallman to support the free software movement and to grant a certain freedom to software users (Caswell et al., 2008). In 1994, the term *learning objects* was introduced by Wayne Hodgins to refer to digital educational resources that could be shared via

the World Wide Web (Wiley, 2006). In 1998, the term *open content* was coined by David Wiley and introduced to the educational community, specifically to the creators of learning objects (Wiley, 2006).

Later, in 1999, Open Courseware (OCW) was introduced by the Massachusetts Institute of Technology (MIT) to situate MIT in distance education and e-learning contexts and to distribute knowledge among educators and scholars worldwide (Caswell et al., 2008). MIT wanted to provide these courses as open content for free; however, they faced challenges concerning intellectual property rights of the embedded materials in the courses (Caswell et al., 2008). Consequently, the following year, Creative Commons (CC) was initiated, which introduced a flexible set of licenses for open sharing and dissemination of copyrighted works (Wiley, 2006). In 2002, MIT launched the project MIT OCW for the public through different initiatives such as the Multimedia Educational Resource for Learning and Online Teaching (MERLOT; Tuomi, 2013). The introduction of OCW was followed by the official launch of OER when, in 2002, UNESCO arranged a forum meeting aimed at discussing the impact of OCW on higher education in developing countries (Conole, 2012; Tuomi, 2013). The meeting established the term *open educational resources*, which was adopted by many different organizations such as the Commonwealth of Learning (COL) and MIT.

Since the establishment of the OER movement, the adoption of this movement has spread to many organizations and foundations such as UNESCO and the Hewlett Foundation (Conole, 2012). At the beginning of the OER movement, researchers such as Khanna and Basak (2013) perceived OER as similar to the idea of learning objects due to the reusable nature of the resources. The Hewlett Foundation and UNESCO asserted that the concept and intention behind the OER movement were to provide free education for all, highlighting that “making educational resources freely available to all is a fundamental right” (Conole, 2012, p. 131). As a result, educators and learners have become interested in using OER and disseminating best practices among themselves (Caswell et al., 2008). In order to understand these best practices and the various aspects of OER adoption in the education sector, we conducted a review of the literature.

## METHOD

We culled literature on OER from the George Mason University Library database (Science Direct, Web of Science, JSTOR, Educator's Reference Complete, and ProQuest Social Sciences Collections), LearnTechLib, Google Scholar, EDUCAUSE, and nationally and internationally published reports. We obtained most data from books, book chapters, and journal articles. We focused the review on literature regarding the application and adoption of OER in the K-12 and higher education contexts; therefore, we excluded studies focused on private publishing companies. We used the following search keywords for surveying the literature: *open educational resources*, *K-12*, *higher education*, *OER adoption*, *OER application*, *OER challenges*, *concept of OER*, and *implications of OER*. Surveyed works were published from 2010 to early 2017 and initially consisted of 138 articles, book chapters, and reports.

After an initial review, we excluded 103 articles not fitting the research focus. These included articles in the corporate sector that focused only on economic and financial aspects of OER, conceptual frameworks of OER that are not examined yet in a context, and studies that have not provided strong evidence of the area under examination. The final number of articles (N=36) included 10 empirical studies and 24 articles that focused on demonstrating the definitions, background, and the potential educational possibilities and benefits of OER.

## ANALYSIS

Defining the gaps in current research regarding the adoption of OER in education requires understanding several aspects. First, the potential benefits of OER introduce several capabilities that educators and students can utilize in teaching and learning settings. Second, preliminary research into OER adoption in education provides an overview of the status of OER adoption in education sectors and gives insights for future research studies necessary in this area, such as identifying the obstacles that hinder OER adoption in specific institutions and determining the factors leading to OER adoption in higher education. After these aspects are explored in the literature review, conclusions and future research implications are discussed.

### **Potential Capabilities of OER**

The adoption of open educational resources in teaching and learning must add value to

different educational disciplines. The William and Flora Hewlett Foundation (2013) has committed to support OER since the beginning of the movement, and in the last 15 years has tried to introduce the benefits of OER to the education sector. They believe in the philosophy that OER can promote equal access to high-quality education everywhere by making a variety of learning materials, lectures, books, curricula, and online courses available on the Internet for little or no cost (William and Flora Hewlett Foundation, 2013). Consequently, the Hewlett Foundation argued that OER have a promising future for improving the access to and efficiency of education at all levels worldwide. They stated that by 2017, OER should be significantly integrated into all educational systems at different levels, including both higher education and K-12, and for-profit and nonprofit organizations. In general, the potential capabilities of OER that are often mentioned in publications related to the OER field can be summarized in five points according to the Hewlett Foundation (2013): (a) to offer access to knowledge for all, (b) to reduce the cost of education, (c) to deliver greater learning efficiency, (d) to promote continuous improvement of instruction and personalized learning, and (e) to encourage translation and localization of content (p. 8).

However, empirical evidence to support these anticipated values of OER is absent, according to the OER Research Hub (OERRH; Weller, De Los Arcos, Farrow, Pitt, & McAndrew, 2016). OERRH is a project of the UK Open University, funded by the Hewlett Foundation, which was developed to address beliefs about these values and to provide scientific evidence about the impact of OER in teaching and learning. Regarding this present debate, OERRH argued that the perceived benefits of OER cannot be robust without providing empirical evidence. They established 11 hypotheses that stand as the assumptions and principles of OER (Weller et al., 2017). These hypotheses highlight different aspects in the use of OER. For example, the importance of OER in improving students' performance and satisfaction, as well as improving retention for students at-risk of finishing their studies. Other hypotheses examine the importance of OER in creating different use and adoption patterns compared to other online resources, OER leading to more equitable access to education, and OER serving a broader base of learners than traditional education. In addition, OERRH established a hypothesis to test the effectiveness of OER in critical reflection by educators.

These hypotheses can be empirically tested by different OER groups and OER

professionals and researchers worldwide. OERRH tested these hypotheses through 15 projects and conducted 20 surveys with over 6000 participants (De Los Arcos, Farrow, Perryman, Pitt, & Weller, 2014). Some of the key findings of this study showed that 37.6% of educators and 55.7% of formal learners reported that using OER improves student satisfaction and 79.4% of users repurpose OER to meet their needs. Around 80% of formal students reported that they saved money by using OER, but finding proper OER materials is one of the biggest barriers to using OER (De Los Arcos et al., 2014).

### **Preliminary Research into OER Adoption in Education**

There are limited empirical studies that explore and examine the implications of OER adoption. The 10 empirical studies that we reviewed examined OER projects and initiatives from different perspectives. Six of these studies examined the degree of awareness and perceptions of OER among faculty and students in higher education institutions and among K-12 teachers, and compared their perceptions regarding OER after they were exposed to it. Four of these studies examined the potential benefits of OER in learning and teaching contexts from different aspects, such as offering a variety of materials, cutting down textbook costs, granting personal spaces for exhibiting knowledge, understanding the factors influencing adult learners to use OER, and the factors might encourage faculty to integrate OER in their courses. The following section provides an overview of the status of OER adoption and its implications in education settings, followed by the key challenges and barriers encountered in this movement. All resources of the 10 empirical studies have been compiled into a table for reference (See Appendix, Table 1).

**The awareness and perceptions of OER in K-12 and higher education.** To date, several studies (Allen & Seaman, 2014, 2016; Davis, Cochran, Fagerheim, & Thoms, 2016; De Los Arcos et al., 2016; Nikoi & Armellini, 2012; Zhang & Li, 2017) have investigated the awareness and acceptance of OER among faculty and students in both K-12 and higher education. For example, Nikoi and Armellini (2012) found that staff and senior managers at two higher education institutions, the University of Leicester and University College Falmouth, endorsed the concept of openly sharing educational resources and stated OER has immense potentials to help different users (e.g., students, staff, self-learners, and people who have limited access to higher education). However, the awareness of OER among participants was limited. They referred to OER as merely information and learning and teaching materials. A foundational

study in this area is the work of Davis et al. (2016). They examined an OER initiative at Utah State University (USU) to explore a simplified process for determining the courses that were most suited for OER use, and how faculty perceived OER adoption. The researchers reported that most faculty integrated the selected OER into their courses and found that open textbooks were the most useful resources (Davis et al., 2016). That is, they could use alternative open textbooks as supplementary materials and promote flexibility in editing and determining certain sections to use.

Tracking the awareness and acceptance of OER among faculty in higher education institutions is important in order to determine weaknesses and strengths in the OER movement. Allen and Seaman (2014, 2016) carried out two studies in successive periods to track the awareness and perceptions of OER among faculty in higher education institutions across the U.S after they were exposed to using it. The authors surveyed 2,144 faculty in 2014 and 3,000 faculty in 2016 representing institutions across the U.S. from all disciplines. Overall, the researchers found that the use of OER was low in general in higher education (Allen & Seaman, 2014, 2016). The majority of faculty were unaware of the term OER; however, they were interested in using it. Of the faculty in the study (Allen & Seaman, 2016), 70% were not OER users, but reported that they would consider using OER in the next three years. Thirty-four percent of faculty, who were somewhat aware of OER, lacked understanding of the legal permissions and fair use of OER (Allen & Seaman, 2014, 2016). Moreover, the findings showed that the faculty used such resources without realizing they were OER content, and they often selected the most cited resources without recognizing the copyright permissions. Furthermore, the results indicated that faculty used openly licensed textbooks as required textbooks for only 5% of courses (Allen & Seaman, 2016). Regarding the quality of OER, the faculty reported that the quality of OER was similar to the quality of traditional materials, but fundamentally, they were unaware of how to evaluate the quality in order to offer their opinions in this area. The findings of these two studies revealed that the status of OER among faculty in higher education was unchanged between 2014 and 2016.

Furthermore, Zhang and Li (2017) conducted a study of faculty members' perceptions of OER at Zhejiang University in China during the 2014-2015 academic year. They sought to explain how adopters of online teaching perceived the attributes of OER. Zhang and Li (2017)

adopted Rogers' (2003) Innovation Diffusion Theory as the theoretical foundation for this study to explain how educators perceive and experience OER based on five attributes: relative advantages, compatibility, complexity, trialability, and observability. The target participants were faculty members at Zhejiang University. The researchers administered questionnaires randomly; 380 faculty members were invited to participate in the survey, and 360 responses were analyzed. The researchers found that the results of this study corresponded with some previous studies (e.g., Acker, Vermeulen, Kreijns, Lutgerink, & van Buuren, 2014) that demonstrated a relationship between individuals' self-efficacy, trust, and willingness to share knowledge. Most faculty endorsed relative advantages and compatibility as attributes of OER, but there were contradictory attitudes toward other attributes of complexity, trialability, and observability, probably due to the faculty's lack of experience in online teaching and awareness of OER.

In the area of K-12 education, De Los Arcos et al. (2016) examined K-12 teachers' perceptions about the use of OER in different contexts, including face-to-face, blended learning, and online learning. The study showed that most K-12 teachers were unaware of the Creative Commons license and the extent to which they could use OER with certain CC permissions. Furthermore, the OER repositories they used most often were YouTube, TED talks, Khan Academy, and iTunes, and the types of OER they used most often were videos, open textbooks, images, and quizzes. In addition, the study showed that teachers in online and blended learning classes used OER more than teachers in face-to-face classes. In the end, the researchers asserted that raising awareness among K-12 teachers about the open licenses is essential, but changing teachers' practices in searching for OER and sharing activities would be more critical in the future.

**The impact of OER adoption on educators and learners.** Recently, considerable research has emerged to investigate the impact of OER on teaching and learning. Research by Pitt (2015) found that the OpenStax (OSC) textbook helped faculty provide resources that met students' needs and that teaching practices became easier. Most faculty preferred to use trusted sources, which are more cited and rated by other faculty, to shortcut the process of searching for materials. Regarding pedagogical changes, few faculty reported on this as they were just starting to use OSC textbooks, but the researcher stated that this needed further investigation (Pitt, 2015). Similarly, in K-12, researchers found that most teachers adapted OER to suit the needs of their

classrooms, and they linked this result with the provision of a strong relationship between OER and personalized learning, in which teachers offered a variety of resources for students and promoted the opportunity to personalize what they learned and how they learned it (De Los Arcos, Farrow, Pitt, Weller, & McAndrew, 2016).

In an analysis of individuals' behavior while using a learning object repository as a facilitator for the adoption of OER, Cohen, Reisman, and Bied Sperling (2015) found that individuals had the opportunity to construct and present knowledge in a unique way that fits their personal style of use and that learning process creators had the opportunity to use content created by others and store it in their private repository in order to adapt and customize it later to meet learner requirements (Cohen et al., 2015). These practices led to a more personalized learning process; improved the quality of the materials, since they were connected to excellent materials across several disciplines; and enhanced individuals' satisfaction with the content they used. Another significant finding of the study was that reusing OER in a personal space created a vibrant community through user activities, such as writing comments, rating, recommending, sharing learning activities, and peer reviews, which increased user trust in the quality of the content of collections (such as MERLOT). The researchers recommend exploring other sharing approaches in personal spaces and showing best practices to further promote OER use (Cohen et al., 2015).

Regarding the impact of OER on learners, studies (Bliss, Robinson, Hilton, & Wiley, 2013; Hilton, Robinson, Wiley, & Ackerman, 2014) have shown that OER significantly helped students save money on textbooks, which led to an increase in their participation and satisfaction. Hilton et al. (2014) reported that the amount of money spent on textbooks for non-Kaleidoscope Open Course Initiative (non-KOCI) - an open education project - was higher than the amount of money saved in Kaleidoscope Open Course Initiative (KOCI) by about \$1 million for one academic year. The results showed significant savings for students who enrolled in KOCI courses. For non-KOCI courses, the average cost of textbooks was \$90.61, which indicated that a total of \$900 was spent annually per student. Broad adoption of OER would make the textbook costs approach zero (Hilton et al., 2014). This finding suggests that OER can benefit not only students, but parents and taxpayers who fund students' enrollment in college. Moreover, among the significant findings of the study conducted by Bliss et al. (2013) in eight community colleges

was that teachers and students collectively reported significant cost savings due to the availability of open textbooks freely online: 80% of students reported textbook prices decreased, 72% spent no money, and 6% spent less than \$20.

**Challenges of OER adoption.** Some studies (Kortemeyer, 2013; Wiley et al., 2014) highlighted that the current trends in the area of sharing and repurposing OER work is to use OER to advance the quality of education, develop policy for OER integration into educational systems, encourage sharing of learning and knowledge, and enhance educators' capacity to deliver quality instruction. With all these possibilities of OER adoption in education, it is still not apparent in teaching approaches because of the many hurdles and challenges. Current issues that encounter the OER community are related to discovering the proper OER materials, quality assurance, and re-mix issues (Kortemeyer, 2013; Wiley et al., 2014).

Discovery is a significant challenge in OER adoption. It refers to the difficulties in finding high-quality OER that meet users' needs. Drabkin (2016) reported that there is an abundance of OER content produced by different states and many districts across the United States in their own repositories and digital libraries, but they are decentralized, and there is no communication between them. The problem of decentralization makes it difficult for teachers to determine the best free resources. Furthermore, the majority of these repositories are not well-organized which makes it harder for the resources to be discovered. Thus, searching for the proper OER is a time-consuming process for users (Davis, 2016). OER researchers (Darbkin, 2017; Kortemeyer, 2013; Wiley et al., 2014) proposed some methods to overcome the issue of discoverability. These methods include rating, tagging, and commenting on OER by using the features of social networks and using recommender services by asking users to like and recommend the best OER for a specific teaching and learning context.

Quality Assurance is another primary issue in the area of OER adoption. In general, people are still skeptical about the quality of free and open resources. Thus, they seek reassurance about whether OER materials have been peer-reviewed (Biswas-Diener, 2017) as peer-review is one of the most used quality control processes in academia. Kortemeyer (2013) argues that the issue of quality control in OER is significant because OER is used as a one-way path, where instructors download OERs from a repository, upload it into a content management system, and deliver and deploy it without assessing learning success or providing feedback on

the original asset for further adaptation or correction. Moreover, if improvements are made, there is no way to replace the original version of the content easily. Wiley et al. (2014) pointed out that rating OER, for instance, in some sites can contribute to the search for quality OER.

The concept of remixing OER is grounded in the idea that people have the freedom to access and repurpose educational resources to meet their needs. However, the greatest effort by users is currently focused on the dissemination of OER as knowledge rather than re-mixing of OER (Amiel, 2013). Thus, the remix issue appears because people lack understanding of the 5R Framework activities that can be leveraged to reuse and remix OER content. Further, educators face difficulties in repurposing OER within traditional pedagogical practices (Wiley et al., 2014).

## DISCUSSION

This literature review presented an overview of research on the implications of OER adoption in terms of the awareness of OER among faculty and students in K-12 and higher education and the capabilities of OER for users. The results of this review support findings from previous literature that found adoption of OER in education is still in its early stages, OER adoption in education is minimal, and the use of OER is a time-consuming process. Additionally, awareness of OER among faculty in higher education and K-12 is still limited and considered a key obstacle confronting OER adoption. One positive indication for OER adoption is that the majority of faculty are willing to try OER and to share OER with other educators. However, the majority of faculty lack understanding of creative commons licenses and the 5R Framework permissions to implement the use of OER in their teaching and research practices.

Regarding the impact of OER on teaching and learning, the research indicates that there is no change noticed in pedagogy practice except that OER offers alternative resources for a variety of learners and, in turn, promotes personalized learning among a variety of learners who use OER to meet their needs. Furthermore, cost savings and ease of use are considered the key motivating factors for continued OER use. In addition, the research revealed that several obstacles and barriers hinder the use of OER including the discovery issue and quality assurance issue, whereby users, in higher education and K-12, have difficulty finding the proper and high-quality OER materials.

When reflecting on the current status of OER, we need to consider the age of the OER

movement. OER is only 15 years old, making it a new research discipline that requires further investigation in different areas. The potential capabilities of OER have yet to be revealed through research. However, adoption of OER is expected to expand access to traditional higher education, as well as distance education and online learning, and OER could be an efficient method to promote lifelong education. Therefore, exploring other possibilities beyond cutting down the cost of textbooks is essential. Several aspects must still be explored and examined.

Most of the studies we reviewed identified successful examples of adopting OER in higher education from a financial perspective. The question that remains is: What are the potential possibilities of OER besides replacing expensive textbooks? To answer this question, further research is required in areas such as the determination of factors of adoption versus non-adoption of OER to ultimately advance the limited perceptions of OER among faculty in higher education and investigation into OER-enabled pedagogy in order to promote remixing of OER through innovating in teaching and learning practices.

Despite the significant interest and appeal of adopting OER in education, the widespread acceptance of this new approach is slow. Researchers regard the minimal OER adoption in the higher education sector as caused by several obstacles that hinder OER in institutions. Some challenges to adopting OER in education involve limited awareness of OER and the use of Creative Commons (CC) licenses among faculty and students in both higher education and K-12. As a result, perceptions of OER have become the subject of research to track the progression of this movement over time (Allen & Seaman, 2014, 2016; Bliss et al., 2014; Pit, 2015). Determining the factors of adoption versus non-adoption of OER will contribute to define the strength area and determine the weakness area in the OER implications that need further attention by experts and researchers. In addition, because most studies examined the perceptions of OER from faculty who are mainly involved in the creation or selection of OER for their courses, a recommendation is proposed to examine perceptions of OER from professionals and leaders who have worked closely with faculty in the adoption of OER. Such a study would provide data to explore the adoption and non-adoption factors of OER from the perspectives of stakeholders other than faculty. This would enable instructional designers to develop an intervention of OER adoption in higher education institutions to help faculty adopt OER into their courses with fewer restrictions.

The studies in this literature review have illustrated that adopting OER by faculty does not show any development or change in pedagogy practices (Pitt, 2015). However, the concept of ‘open’ grants the promotion of open practices in education by engaging in the 5R permissions framework to use open educational resources freely in different contexts. Therefore, there is a demand for an in-depth qualitative study exploring how OER might affect teaching and learning by improving pedagogical models. In other words, how can faculty engage in a wide range of pedagogical innovations due to the permissions granted by OER? In fact, to widen the adoption of OER across higher education institutions, OER’s effectiveness in teaching and learning must be proven. Allen and Seaman (2014) argued that for faculty to adopt OER, they need scientific evidence that OER has been proven to be effective and credible in teaching and learning contexts. Designing a study to explore the potential possibilities of OER in making a change in existing pedagogy practices would address this concern and contribute to the synthesis of new knowledge and experience within the body of OER-enabled pedagogy. To do so, OER materials could be assigned to course readings lists. The instructions for predetermined course assignments could be designed to promote student-created OER that can be published publicly under a CC license in which students’ works could be shared and reused by other learning communities.

### CONCLUSION

This research explored the concept behind open educational resources and its applications and implications in education. It is believed that OER has promising benefits for institutions, educators, and students and that the open nature of OER promotes users the possibilities of practicing the 5R Framework activities. Thus, to improve the quality of education by using OER according to the William and Flora Hewlett Foundation (2013) vision, remixing and revising OER needs to be embedded in teaching and learning practices to contribute to increase learning efficiency. These practices of remixing and revising contribute to continuous improvement of OER materials and enhance its quality over time, which is a critical issue in OER adoption. In general, demonstrated best practices of OER use in teaching and learning practices leads to raising the awareness of the value of OER in improving the quality of education in different aspects, such as lowering the cost of higher education, innovating pedagogical models and increasing students’ satisfaction and engagement in creating knowledge that is accessible to all

without constraints.

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#### AUTHOR BIOGRAPHIES

##### **Maimoona Al Abri**

Maimoona Al Abri is a candidacy doctoral student in the Learning Technologies Design Research Ph.D. program of College of Education and Human Development at George Mason University. She holds an MEd in Learning Technology from Griffith University, Australia. She is the director of Educational Technology Department in the Ministry of Education in Sultanate of Oman since 2013. In 2017, she was nominated for Kappa Delta Pi (Education Honor Society) and became a DOER (Designing with OER) Fellow. Maimoona’s research interests include online learning, open educational resources (OER), open educational practices, open pedagogy, user experience design, and technology integration in schools.

**Dr. Nada Dabbagh**

Nada Dabbagh is Professor and Director of the Division of Learning Technologies in the College of Education and Human Development at George Mason University. She holds a Ph.D. in Instructional Systems Design from The Pennsylvania State University and an M.S. in Operations Research from Columbia University. Her research explores the pedagogical ecology of technology mediated learning environments with the goal of understanding the social and cognitive consequences of learning systems design. Specific research areas include personal learning environments, problem-based learning, affordance-based design, and supporting student self-regulation in online and blended learning.

**APPENDIX**

Table 1

*Preliminary Research into OER Adoption in Education*

Focus and Reference	Context and Subject Addressed	Sample	Method	Key Findings
Bliss, Robinson Hilton, & Wiley (2013)	Perceptions of OER cost, outcomes, uses, and quality in higher education	Community colleges (N=8), teachers (N= 58), & students (N= 490)	Large-scale survey	There are significant cost savings. Open textbooks to be at least equal in quality of traditional textbooks.
Allen & Seaman (2014)	Perceptions of OER in higher education	Faculty across U.S. (N=2144)	Large-scale survey	A high percentage of faculty unaware of term ‘OER,’ but, they were willing to try using it. They lack understanding of OER permissions.
Allen & Seaman (2016)	Awareness of OER in higher education	Faculty across U.S (N= 3,000)	Large-scale survey	Majority of faculty unaware of the term ‘OER,’ however, they are interested in using them. Generally, the potential of using OER are low.

(Continued)

Table 1 (Continued)

Focus and Reference	Context and Subject Addressed	Sample	Method	Key Findings
Nikoi & Armellini (2012)	Awareness of OER in higher education	Staff & senior managers (N=19), & students (N=71) at two institutions in the UK	Survey and interview	Participants endorsed the concept of OER.
Zhang & Li (2017)	Perceptions of attributes of OER	Faculty (N= 360) at Zhejiang University in China	Survey	A relationship between individuals' self-efficacy, trust, and willingness to share knowledge. Most faculty endorsed relative advantages and compatibility as attributes of OER.
Pitt (2015)	Perceptions of impact of OER in higher education	Faculty and students from over 180 countries who used OpenStax textbooks	Survey (N=7000) and interview (N=8)	OER helps faculty to provide resources that met students' needs. Teaching practices became easier. OER significantly helps students to save money and increased students' satisfaction.
Hilton, Robinson, Wiley & Ackerman (2014)	Impact of OER on cost saving in higher education	Seven community colleges involved in the KOCI project	Collecting textbooks prices	Using OER in HE significantly saved students' money
Cohen, Reisman, & Bied Sperling (2015)	Impact of OER adoption in teaching and learning in higher education	Users in Merlot	Analytic data	Individuals built and exhibited knowledge in a particular path to fit their style of use. Increase in the personalized learning process. Increase in the quality of OER materials.

(Continued)

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Table 1 (Continued)

Focal Focus/ Reference	Subject to address	Sample	Method	Key findings
de Los Arcos, Farrow, Pitt, Weller, & McAndrew (2016)	K-12 teachers' perceptions of the use of OER in different contexts, face-to-face, blended learning, and online learning	K-12 teachers (N= 657) worldwide	Survey	Most K-12 teachers were unaware of the Creative Commons license. The primary challenge was the discoverability issue and quality of OER. There is a strong relationship between OER and personalized learning.
Davis, Cochran, Fagerheim & Thoms (2016)	Acceptance of OER adoption in higher education	Faculty (N=49) at Utah State University	Survey	Streamlined process of integrating OER into courses has been created that can be utilized by different higher education institutions. Faculty are provided with useful OER and they integrated these resources into their courses.