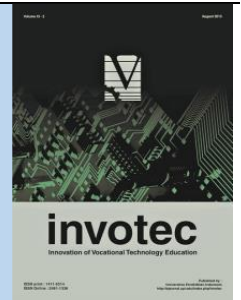




## Innovation of Vocational Technology Education

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### Open Educational Resource (OER): Achievements, Costs, and Challenges?

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#### ABSTRACT

The Open Educational Resource (OER) is a source of digital learning materials that can be accessed, used, and distributed by everyone and is copyright licensed. This study aims to conduct a systematic library review in investigating the impact of Open Educational Resource (OER) implementation on student learning outcomes, the impact of OER on costs for students and learning challenges using OER. The method used in this study is Systematic Literature Review (SLR). This paper presents a publication review paper (2015-2020) or the last 5 years on OER. The article search process uses search techniques using the keywords OER (Open Educational Resource), Open Educational, and MOOCs (Massive Open Online Course) on those from reputable article databases. The selected article is then sorted by the inclusion criteria process and the findings are synthesized to answer the problem formulation. The findings suggest that the effectiveness of OER learning and conventional textbooks has no significant differences, both of which have the same learning outcomes. In terms of costs, OER has an impact on saving students' money. The challenge of learning in the future is the need for intensive support for teachers so that there is no longer a gap in teacher understanding related to OER. The role of librarians is required to collaborate in developing, modifying, and distributing OER, as well as in advocating to support the appropriate use of OER between teachers, students, and institutions. Research has implications as a strong foundation in designing and implementation strategies related to OER in education.

#### 1. Introduction

Covid-19 has changed the paradigm of education to be more open and flexible. The phenomenon of education and knowledge combined with communication has developed and spawned an Open Education Resource (OER) system. The OER system is considered to be able to

expand educational opportunities by using the internet allowing fast and free deployment to access connected and collaborative knowledge. OER also provides assurance and openness to remove barriers to education (Clinton, 2019; Hakim, 2017).

Some of the educational barriers that occur such as the high cost of education, the increase in textbook prices, and the understanding of copyright about OER are also considered to have an impact on the change of education to be more open (Iii, 2020; Smith & Lee, 2016; Thompson & Muir, 2019). Also, OER's commanding in learning is still concerned about the type, quality, and manner of its application (Katz & Katz, 2019). Even more than 50% of the teachers surveyed stated that they do not yet know the OER and how they can use it (Barneva et al., 2019). Therefore, the exemption of students from costs and increasing the number and quality of OER is one alternative to removing OER learning barriers (Colson et al., 2017).

OER is educational material that is openly available to teachers and students at no usage fee (Davis et al., 2016; Reed & Jahre, 2019). OER is defined as pedagogical material that is free and openly licensed so that it can be accessed, reused, and widely distributed by educators, students, and the general public (Hess, Nann, & Riddle, 2016; Kruger & Abramovich, 2019; Vogus, 2019). OER material is licensed under an open copyright license or in the public domain (Wiley, Bliss, & McEwen, 2014). The copyright license, for example, is Creative Commons or in the public domain means it is freely accessible and can be revised, remixed, reused, and redistributed by others (Fialkowski et al., 2019).

OER components include courses, course materials, modules, textbooks, assignments, streaming video assessments, tests, software, materials, and various types of media used to support knowledge access (Hess et al., 2016; Smith & Comyn, 2004). In making it easier to present figure 1 of various categories of OER according to taxonomy as follows.

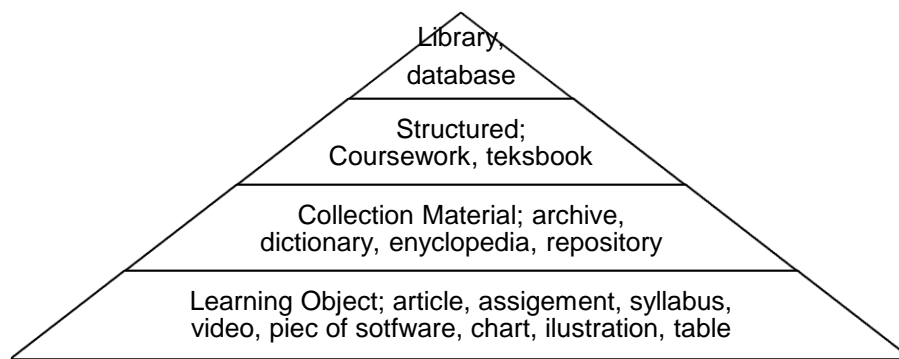


Figure 1. Types of Open Educational Resources by structure (Barneva et al., 2019)

Also, OER types are distinguished by content i.e. textbooks, courses, journals, software, tutorials, encyclopedia, data, videos, images/ photos, presentations, assets. Figure 2 below presented OER sources by content type.

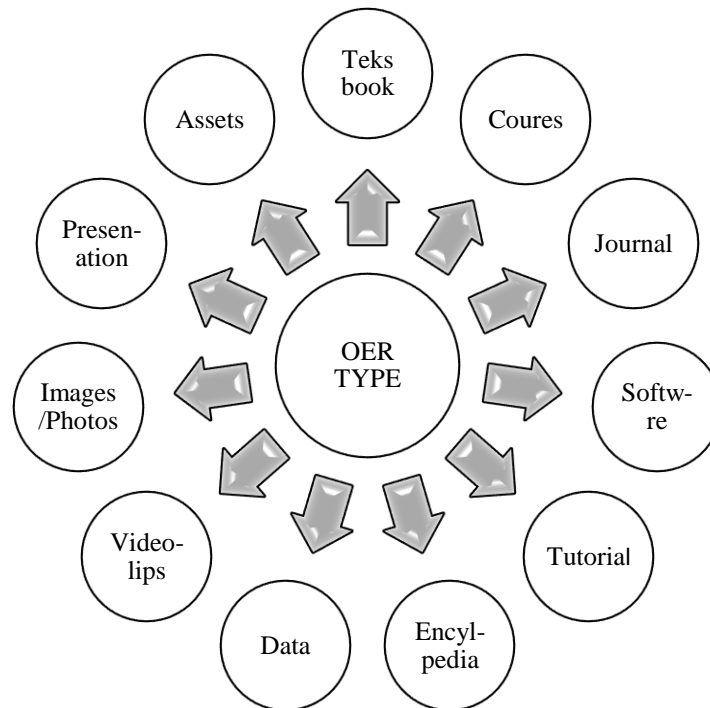


Figure 2. Types of Open Educational Resources (OER) by content (Barneva et al., 2019)

UNESCO (2002) defines OER as "teaching, learning or research material that is in the public domain or released under an intellectual property license that allows the use, adaptation and free distribution (UNESCO). While the Paris Declaration is agreed that OER constitutes teaching, learning, and research materials in any medium, digital or other public or has been released under an open license that permits access, use, adaptation, and redistribution by others without or limited restrictions. An open license is established that already exists intellectual property rights framework as defined by the relevant international conventions and respects the authorship of creation.

OER at a time when Covid-19 conditions are considered increasingly important (Huang et al., 2020). Many institutions, practitioners, teachers in education have observed this trend. Some are just starting, or are starting to explore the use of OER as an alternative to conventional textbooks as their first-class curriculum (Atenas & Havemann, 2014; Goodsett et al., 2016; lii, 2016; Reed & Jahre, 2019). In addition to the implementation of OER by teachers, it is necessary to access to provide content as a learning material portal. Learning resources portal can be developed by librarians in schools or universities.

Libraries are often part of initiatives to help drive the adaptation or development of OER systems. As has been done in the state of Georgia, where the University of Georgia system is led by an academic library system. They help faculty find and gain access to low-cost, free, or open electronic learning resources in the public domain as well as materials provided by the university's library system (Colson et al., 2017). So the implementation of the developed OER frees students from expenses and controls restrictions on access to materials commercially (Clinton, 2019).

So far there has been no research that examines the phenomenon of OER associated with achievement, cost savings, and learning challenges in its entirety. Therefore, it needs to be further researched as a discussion material in this study. The purpose of the study focused solely on investigating and synthesizing the findings in the article on how the implementation of OER in improving learning achievement, the impact of OER on cost savings, and OER learning challenges going forward. The systematic literature review method was chosen to synthesize the results of research that utilizes OER in learning. In this study, a total of 29 articles were selected as the material to answer the problem formulation.

## 2. Methods

The method used is Systematic Literature Review (SLR). A systematic literature review is a method of conducting literature reviews and reporting various research results to explore problems so that the designed problem formulation can be answered (Parris & Peachey, 2013). The design of systematic literature review studies can provide an overview, evidence from various sources, thus providing help in building the foundation on the area of research to be researched. The systematic literature review also facilitates the expansion and improvement of theory, opens up research gaps, and uncovers areas that have not been the focus of previous research. This study designed the results of the investigation with the following problem formulation.

### 2.1 Investigation of research question

- How does Open Educational Resource (OER) impact learning outcomes?
- How does Open Educational Resource (OER) apply to cost savings?
- What are the challenges of Learning Open Educational Resource (OER) in the future?

### 2.2 Search techniques

To answer the research questions above, some search keywords are used. As shown in Table 1 below are the keywords used are a combination of synonyms that can be categorized in the use of OER (Open Educational Resource), Open Educational and MOOCs (Massive Open Online Course). Searches are conducted in different electronic databases including Taylor and Francis databases, Sage, Sciencedirect, Springer, and Google Scholar.

Table 1. Literature search keywords

No	Search Keywords
1	<i>Open Educational Resource (OER)</i>
2	<i>Open Education</i>
3	<i>Massive Open Online Courses (MOOCs)</i>

### 2.3 Criteria of exclusion and inclusion

Criteria of exclusion and inclusion are intended in the process of filtering articles. Selecting article criteria relevant to topics and keywords to provide information on research problem formulation answers is an important part of this kind of study (Bourcet, 2020). Based on the criteria of exclusion and inclusion in Table 2, the inclusion criteria that include the study must be written in English and published in the last 5 years between January 2015-December 2020. Articles of the journal and conference articles fall into the criteria of inclusion, while books, thesis, and thesis fall into the exclusion criteria. The results of the article included in the inclusion were written to see the suitability in answering the formulation of problems such as the impact of OER on learning outcomes, OER learning savings, and OER learning challenges in the future. In more detail is summarized in Table 2 of inclusion and exclusion criteria.

Table 2. Inclusion and exclusion criteria

No	Geographic Criteria	Inclusion content	Exclusion content
1	Language	English	Non-english
2	Years of Research	Last 5 Years: January 2015- December 2020	Over the last 5 years of December 2014 to the previous
3	Publication Type	Conferences or Journal Articles	Thesis, dissertation, book
4	Effect	Describe learning outcomes and financing using OER	Doesn't answer research question
5	Challenge	Describe the challenges of OER learning ahead	Doesn't answer research question

### 2.4 Data extraction and analysis

Each article is reviewed based on five items, as presented in Table 2. These items provide information to answer research questions. Lastly, qualitative synthesis is conducted to answer research questions.

## 3. Results and Discussion

The article review process covers three stages, namely article search and retrieval, article filtering and sorting, analysis (Nugraha et al., 2020). In figure 3 below is described a flowchart of the search stages of the article.

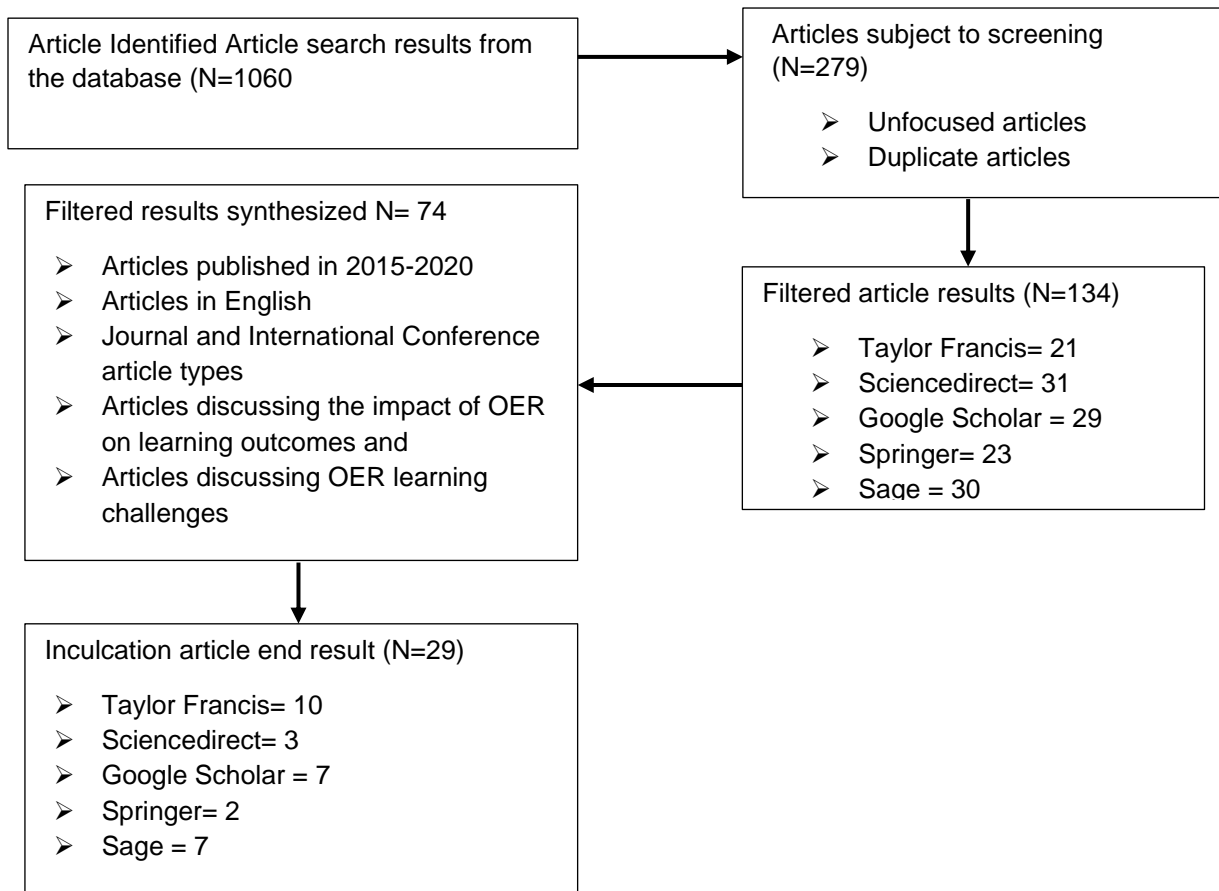


Figure 3. Flowchart process Systematic Literature Review (SLR)

### 3.1 Distribution of articles by year of publication

The distribution of articles from the last 5 years of January 2015 - December 2020 increased and decreased. The increase began in 2015 to 2017, but in 2017 to 2018 decreased. It increased again in 2019, but by the end of 2020, it was decreasing. The fewest number of articles were achieved in 2015 (N=0). The biggest increase in publications was peaking in 2019 (N= 9). Fluctuations in the distribution of articles can be seen in graph figure 4 below.

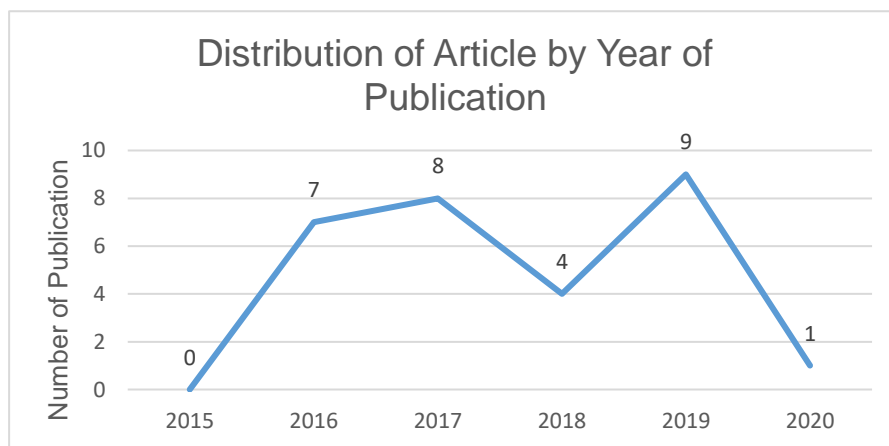


Figure 4. Graph of the distribution of OER articles from 2015-2020

### 3.2 Distribution of articles by country

Based on Table 3 below is the distribution of articles by country (N = 29). The highest number was USA (N = 14), followed by Canada (N = 4), then Georgia (N = 3), New Zealand (N = 2), and finally Indonesia, Hawaii, Sri Lanka, Netherland, Austria with the total frequency which is the same, namely (N = 1). USA is the country with the highest dominance in the Open Educational Resource (OER) research area as evidenced by the highest number of publication contributors.

Table 3. Article distribution by country

No	Country	Frequency
1	Indonesia	1
2	United States of America (USA)	14
3	Georgia	3
4	Hawaii	1
5	New Zealand	2
6	Srilanka	1
7	Canada	4
8	United Kingdom (UK)	1
9	Netherland	1
10	Austria	1

In figure 5 below, a spread map shows the top contributors of countries around the world who conducted the most research on OER topics in 2015-2020. The USA country is the top contributor to the country with the greatest number of articles (N=14). While the fewest number of articles are some countries with the same number of Indonesia (N=1), Hawaii (N=1), Netherland (N=1), Austria (N=1).

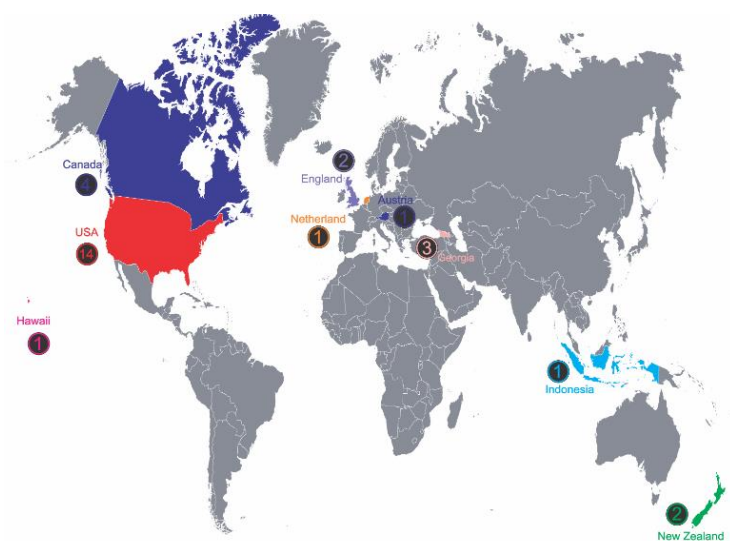


Figure 5. Map of article contribution distribution by country

### 3.3 Distribution based on keywords

Figure 6 below is a graph of the number of articles in terms of keywords. Based on the search results for keyword articles, the most common is Open Educational Resource (OER) (N = 24), the second most is the keyword Massive Online Course (N = 3). Furthermore, the number of Open Education keywords is the least found with (N = 2).

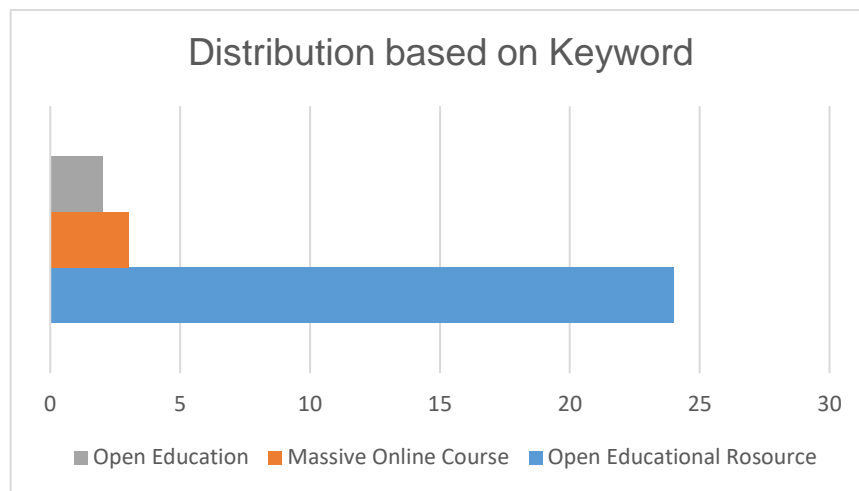


Figure 6. Distribution of articles based on keywords

### 3.4 Distribution based on journal database

The process of finding articles in accordance with the objectives of the problem needs to be strictly selected, so as to produce relevant quality articles that can answer the problem formulation. In this study, the Taylor and Francis journal database is the most downloaded data base by the number (N = 10), the second largest, respectively Sage and Google scholar, each with the same number (N = 7), the third highest is Sciencedirect (N = 3), and finally springer by the number (N = 2). Figure 7 below is presented the total database of journal articles.

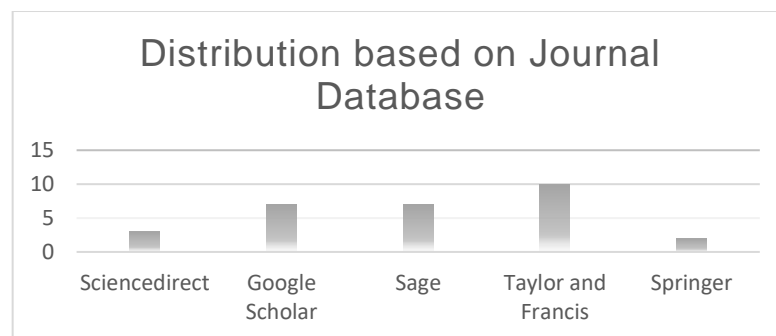


Figure 7. Distribution of articles based on database



### 3.5 The effectiveness of using Open Educational Resources (OER) in learning

The alternative to conventional learning, namely using textbooks, has begun to be replaced by the existence of OER. Conventional learning that uses textbook sources is considered to be less flexible and cannot expand access to education. Increasing prices for textbooks, coupled with higher education costs in general have led some teachers to experiment using classrooms by replacing traditional sources with OER open education resources (Iii, 2016; Kim et al., 2020).

OER as a digital education material offers educators and students to do face-to-face, distance, online learning together informal and non-formal contexts. OER is widely used as an online platform as a learning resource so that students get more information. Students can be free to look for modules and references according to their needs (Stracke, 2017).

OER learning has been used by students, teachers, students and has had a positive experience impact (Iii, 2020; Vogus, 2019). OER learning is considered to be able to improve the effectiveness and quality of learning (Mishra, 2017). The quality of learning at OER affects aspects of the experience of the learning atmosphere maximally, such as reusing material and copying material according to the speed of the learning style so that students can take advantage of access to the material whenever needed (Chiorescu, 2020; Kopp, Gr, & Zimmermann, 2017).

Learning using OER has the same learning outcomes using traditional sources (Clinton, 2019; Iii, 2016). This is evidenced by the results of research Engler and Shedlosky-shoemaker (2019) on an introductory psychology course, where the results show that there is no significant difference in content mastery between students in an introductory psychology course given traditional commercial textbooks and those given books. OER text. Conventional textbooks and OER are equally effective and have implications for the selection of the most important course materials as teachers can help ensure access to all students (Miller & Homol, 2017).

The results of other studies show that students generally achieve the same learning outcomes when using OER (Iii, 2016) investigating the relationship between OER and learning outcomes in a total of 46,149 students, it turns out that only one of these nine studies shows that the use of OER has low results on learning outcomes. The results of other studies support that textbooks and OER on introductory nutrition courses do not have a significant effect on learning outcomes (Fialkowski et al., 2019). Both sources have the same results on improving learning achievement. Therefore, the application of OER is considered necessary to apply a lot of good methodology in producing innovations that provide easy absorption of learning outcomes. Educational libraries need to help as supporters and providers of access to OER resources to make it easier for students (Reed & Jahre, 2019).

### 3.6 The impact of implementing Open Educational Resources (OER) on cost reduction

Open Educational Resource (OER) although it does not have a significant impact on improving learning outcomes. However, it can be a solution that reaches the latest information, reaches

students, practitioners, and teachers in accessing learning resources that are freely available and openly licensed (Atenas, Havemann, & Priego, 2015). Also, students from low socioeconomic groups benefit greatly because they can reduce the cost of purchasing textbooks (Colvard, Watson, & Park, 2018).

The cost of purchasing textbooks has tripled in college and it is estimated that students spend around 1,200 USD on books and supplies each school year (Chiorescu, 2020; Colson et al., 2017). The affordability of textbooks is becoming increasingly a challenge for students. The right solution is to replace expensive learning resources with OER which can have a major impact on reducing or saving costs for post-secondary education and student learning (Chiorescu, 2020; Colvard et al., 2018).

Results show that OER adoption is more than just saving students money at a cost that is reasonable for students, but without buying new textbooks (Katz & Katz, 2019; Kruger & Abramovich, 2019). The study conducted Iii (2020) also supports the impact of OER adoption which has a major impact on reducing the cost of education. According to Fialkowski et al. (2019), it found that a percentage of 65% of students reported not buying textbooks due to price factors, although 94% of students believed they would be badly affected if they did not use textbooks. This reason is reasonable because they can complete the task well without using textbooks (Kinskey et al., 2018).

Implementation of OER textbooks although it has an impact on cost reduction but needs a high quality OER learning model that is available for free to students and institutions.

### 3.7 Open Educational Resource (OER) learning challenges ahead

In response to the broken textbook free market, libraries became actively involved in the OER movement's efforts. The OER movement has successfully slashed the potential for overcharging for students to buy textbooks (Goodsett et al., 2016). So that the textbook market becomes less desirable by stakeholders, students, teachers, and educational practitioners.

The challenges of OER learning in the future no longer reduce the cost of education such as textbook purchases but can further improve the quality of learning. The quality between expensive traditional textbooks and OER ones should be as good (Goodsett et al., 2016). Some obstacles become a concern where teachers as teachers lack understanding of OER, the availability of OER so it takes additional time effort to learn to use it (Colson et al., 2017). But according to a study (Thurtle et al., 2016), the lack of understanding of OER is not due to lack of internet access but rather the ability to understand OER learning.

The framework should be designed so well that teachers or instructors, students, and policymakers are aligned to support the implementation of OER. The development of the framework must be able to accommodate both students, teachers, and policymakers (Hakim, 2017). As developed by Universitas Terbuka Srilanka (OUSL), where designs and developments that support the adoption of OER using Scenario-based learning (SBS), scenario-based learning outcomes

integrated with OER can overcome challenges, as well as significantly improve learning outcomes (Karunanayaka & Naidu, 2018).

The role of teachers in implementing learning integrated with OER is not an easy challenge. The role of teachers in addition to designing the content of materials in learning also needs to prepare the motivation of learning, the availability of materials delivered (Littlejohn & Hood, 2016). Also, there needs to be intensive support for teachers who make OER materials so that teachers become more focused on the success of learning achievements rather than anything else. Furthermore, teachers need to continue learning with various OER platforms, therefore there is no longer a gap in teacher understanding related to (Thompson & Muir, 2019; Vogus, 2019). The movement towards OER resulted in teachers constantly updating the changing science of pedagogic practices thus improving access to isolation for all students (Katz & Katz, 2019).

Libraries and librarians in the institution are the drivers of the development of OER as a method of reducing textbook costs (Katz & Katz, 2019). The new role of librarians who participate in developing, edifying, and distributing OER, as well as in advocating for its use (Burch V & Smith, 2017). Early collaboration is critical to encouraging librarians to identify to target the most appropriate learning to adopt OER between student teachers and institutions (Davis et al., 2016). Furthermore, the library as a learning information center expert plays an active role in bridging licensing ownership as the copyright of OER material creation (Reed & Jahre, 2019).

Lastly, the perception of students in OER learning wants to be able to help their learning so that they have the freedom to learn according to their needs (Hakim, 2017). The student's need is to want a multimedia digital textbook that combines interactive media to provide a new learning experience (Verkuyl et al., 2020).

Research has implications as a strong foundation in designing and implementation strategies related to OER in education. Policymakers, librarians, teachers, and students should play an active role in helping to integrate the OER curriculum. The need for understanding all elements of education so that learning using OER in addition to reducing costs can also improve the quality of learning.

#### **4. Conclusion**

Based on research that has been reviewed from various articles by investigating the effectiveness of OER learning, the impact of OER on the cost and challenges of OER learning. The findings showed that the effectiveness of OER learning and conventional textbooks made no significant difference, both of which had similar learning outcomes. Many studies have published that the use of OER has a huge influence on student money savings. The challenges of OER learning in the future no longer reduce the cost of education such as textbook purchases but can further improve the quality of learning. There needs to be intensive support for teachers who make OER materials so that teachers become more focused on the success of learning outcomes rather than anything else. Furthermore, teachers need to continue learning with various OER platforms,

therefore there is no longer a gap in teacher understanding related to OER. The role of librarians should be to collaborate in developing, management, and distribution of OER, as well as in advocating for its use to target the most appropriate learning to adopt OER between student teachers and institutions. Students wanting OER learning to help them learn so that they have the freedom to learn as needed such as multimedia digital textbooks that incorporate interactive media to provide a new learning experience. Research has implications as a strong foundation in designing and implementation strategies related to OER in education. Policymakers, librarians, teachers, and students must actively assist in the implementation of the curriculum and provide legal permission to provide OER services.

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