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A vision of teaching learning practices in mathematics education through open educational resources

K. Sathish Kumar[1*], M. Mahendraprabu[2], G. Kalaiyarasan[3], R. Ramnath[4], N. Sasi Kumar[5] and Mani Mookkiaha[6]

[1]Research Scholar, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: sathishsxce1993@gmail.com

[2]Assistant Professor, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: eduprabu2011@gmail.com

[3]Professor, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: gkauce@yahoo.com

[4]Assistant Professor, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: rrnathedu@gmail.com

[5]Assistant Professor, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: sasismile25@gmail.com

[6]Research Scholar, Department of Education, Alagappa University, Karaikudi 630 003, India. E-mail: mani.pro4689@gmail.com

Abstract

In particular, research papers on the view, practice, and teaching-learning of free educational resources in mathematics education research papers are scarce. In this research work, it will present a brief overview of Open Educational Resources (OER) in respective of its advantage, disadvantage, use, implemented area, effect in the education system, etc. It had utilized an essential role in the current research scenario. Over the past few years, OER has grown exponentially to meet its needs. This development is a necessary need of the twenty-first century. In the improvement of education quality, OER brings to make the education digitalized with modern-day technology. In the present time, OER is widely using in institutions for upgrading the era of the pen-notebook period to the digital study era in the context of making the availability of education cum resources anytime, anywhere, to any person. Education should be free, and OER mainly supports as well as promote that thought.

Keywords: *Open Educational Resources (OER), Information and communications technology, Open Educational Practices (OEP), Massive open online courses, Teaching and learning, Mathematical education*

1. Introduction

UNESCO first introduced the term Open Educational Resources (OER) and used it in 2002; OER mainly defines the freely available educational resources with copyright (Mahendraprabu *et al.*, 2021). OER function with the help of information and communications technology-based free educational resources. The open educational resources mainly focus on the teaching-learning process through online mode. Available educational resources are given educational materials easily and quickly to everyone in the world. Massive Open Online Courses (MOOCs), open digital textbooks, and video lectures are the most popular open educational resources (Kumar and Mahendraprabu, 2021). It will be accessible on free expense and open authorized. OER has several scopes in terms of its use and teaching and learning perspective (Alevizou and Forte, 2010). The major problem of the school system is learning mathematics. The issues need solutions.

One of the simple solutions is to open educational resources. Open educational resources help both teacher and the student improve the teaching-learning process (Sapire and Reed, 2011). Modern education is under the hand because technology is incredible growth in the current education system (Czerniewicz *et al*., 2020). The students and the teachers are using mobile phones for getting open educational resources (Neuhold *et al*., 2018). The MOOCs and SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) are the online learning platforms for getting knowledge (Kim, 2015).

2. Open Educational Resources (OER)

'OER' is known as specialized study materials provided free and open access for teachers, students, and self-educators to utilize and restate use for teaching-learning process and research (D'Antoni, 2009; Downes, 2007). 'OER' is designed to facilitate learning and teaching for free and easy use by all people with the help of a creative commons license. OER is an open license material that everyone can use for learning (Gachago *et al*., 2017). Creative Common (CC) license is also a profitless organization system that can issue free licenses (Bissell, 2009).

3. OER use process

The open educational process is to follow certain norms in the cyclic process. The educator or publishers publish the OER content using an open license like metadata, such as author, author, language, subject, etc. The free educational resources have available the different formats (audio, image, video, and text), then the open educational resources are permanently stored in the OER repository. The learners are getting available educational resources freely through a free license. These open educational materials are remix, revise, retain, reuse and redistribute to the learners. The OER utilization process is given below (Figure 1)
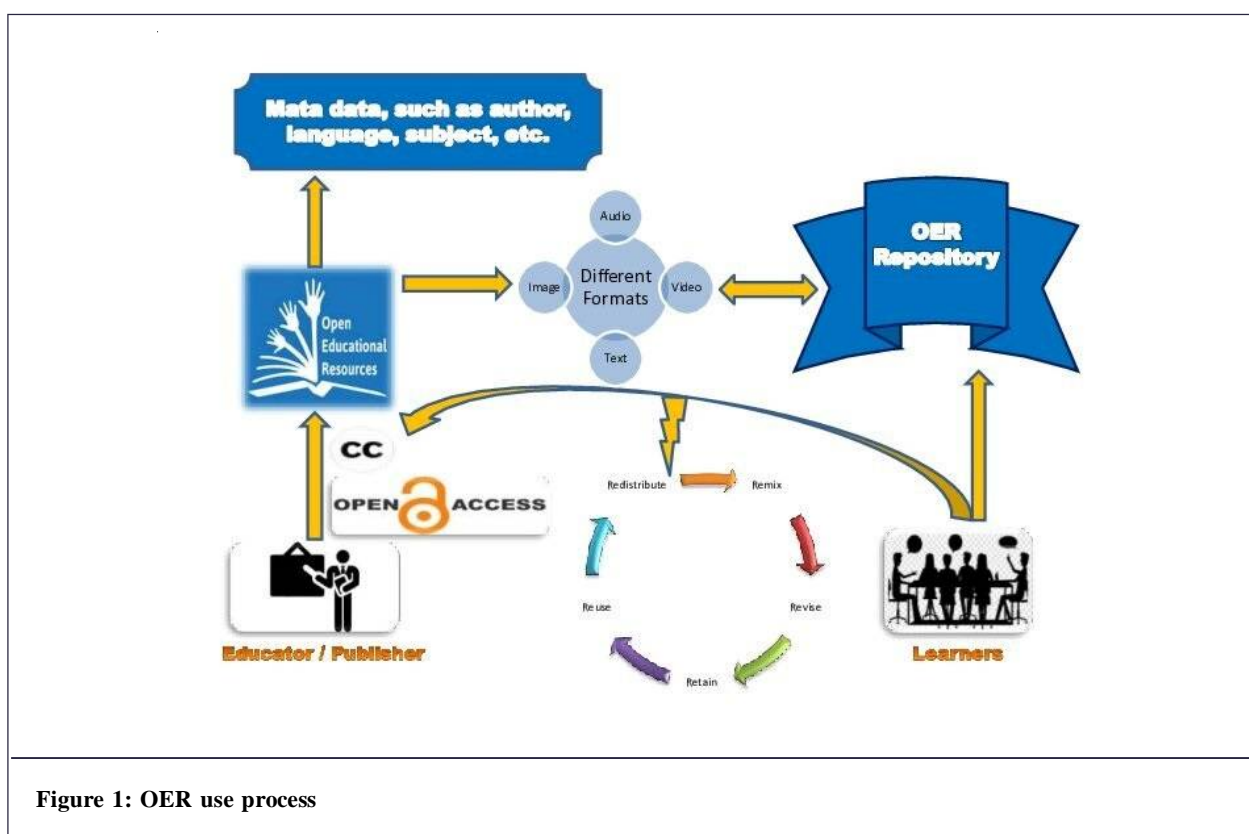

Figure 1: OER use process

4. OER TO OEP

Open Educational Practices (OEP) is defined as 'practicing the reproduction and utilization of open educational resources through new innovative technologies and policies and creating a learning situation among the learner's (Ehlers, 2011). The researcher's final opinions about open education from content-centric approaches target producing, inventing, and distributing educational materials in different formats (audio, video, text, etc.). The practice-centered process is a combination of students and educators to invent and disseminate new knowledge (Cronin, 2017). As shown in Figure 2,

the researcher and teachers target inventing and broadcasting OER utilizes that can be practicing OER for the teaching-learning process, which indicated as open educational practices. In 2019 open educational resources are approved by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in all education systems (Mahalakshmi *et al*., 2020).

5. Literature review

Downes (2019) presented a view on "A Look at the Future of Open Educational Resources." First, he has been discussing the traditional method of learning methods of resources. Then he describes the easily accessible and free license. In there, he had explained the modern technological world open educational materials. Then he presented the cloud infrastructure, accessible data, artificial intelligence, and decentralized networks. Lastly, they concluded the community-based process and pedagogy-based educational practice for the students.

Sapire and Reed (2011) presented a view on "Collaborative design and use of open educational resources: a case study of a mathematics teacher education project in South Africa." First, they discussed the learning problem of mathematics learners in the current situation and mathematics learning solution overall in the school system. Then, they elaborate on what new technologies are very useful in mathematics learning. Then, they had explained the possible methods and technologies that are testing in mathematics from collaborative learning. In particular, they described how open educational resources function in the mathematical teaching-learning process. They conducted a survey study among school students. Finally, they say that open educational resources are essential to the modern educational system, and they give some recommendations to open educational resources development. The educational policy should focus on students' open educational resources, a research scholar in the correspondence courses.

Orey and Rosa (2018) presented a view on "Developing a mathematical modeling course in a virtual learning environment." First, they had researched Brazil's higher education opportunity. In particularly examined the mathematical educations, they find there is no opportunity to study in Brazil. In there, they had been detailed Mathematical Modeling course at Brazil Distance Education University. They then conducted the survey study methods and formed a questionnaire and qualitative data collected through a survey study. After that, they had provided that educational resources and technological resources are available in the teaching-learning environment.

Hilton *et al*. (2013) researched "The adoption of open educational resources by one community college math department": They had been discussing on the e-books is freely available and low cost for access to the materials. They describe the aspects of online open textbooks and OER in the mathematical classroom environment. In there, they had presented different types of free online courses for mathematical education. In there, they had surveyed both student and teachers performance and utilization of OER. They conclude with student and teacher's perception of an open textbook. Open textbooks are free of cost, easily accessible, and develop the teaching-learning process.

Park and McLeod (2018) presented a view on "Multimedia Open Educational Resources in Mathematics for High School Students with Learning Disabilities." First, they had been discussing the necessity and flexibility of open educational resources. Then they describe the aspects of OER repositories and the success of open educational resources in the mathematics classroom with learning disabilities. They had presented utilizing multimedia OER in the mathematics classroom with learning disability students. Then the result is measure with motivation and achievement. Finally, they conclude with multimedia open educational resources are developing the effective teaching-learning process in the mathematics classroom with a learning disability.

Hilton (2016) presented a view on "Open educational resources and college textbook choices: a review of research on efficacy and perceptions." First, he had described as the college textbook essential and the very high cost of purchase for higher education students. Then he presented the business textbooks as their first stage of formal education. In there, he explained the influence of OER learning development and thought of OER in higher education. Finally, he had been finding that the learners are getting a similar result of achievement. It is a low cost compare with traditional teaching. These OER learning outcomes are useful for both educators and learners.

John Hilton III *et al*. (2019) researched "Substituting open educational resources for commercial curriculum materials: effects on student mathematics achievement in elementary schools." First, they had discussed the OER is the possible solution for substituting commercial textbooks. Then they conduct the study of elementary school students in mathematics subjects and survey open educational resources and traditional materials/commercial resources in five different elementary schools in the United States of America. Finally, they found that the learners are getting more knowledge without losing money, performance, and practical study.

Misra (2018) presented a view on "Lifelong Mathematics Learning for Adult Learners and Open Educational Resources." First, he had been discussing the lifelong practicing learning and adult learners hurdles. Then he presented the OER concepts and characteristics and advantages. Then he examined the OER and promoted lifelong learning in mathematics all around the world. He was utilizing OER for Lifelong Mathematics Learning of mature learners in possible ways. Then he creates e-books, OER supported Mathematics Learning Communities for adult learners.

Gorse *et al.* (2009) presented a view on "Virtual Maths: Contextualized learning with new and emerging technologies." First, he had been discussing the mathematical problems of the teaching-learning process. Then he presented the developing idea of open educational resources and e-books. Then he had been discussing the creation of virtual learning and communicative web-based mathematics problems. Then he had been discussing mathematics in a real-life situation using new technology. The analysis had conducted through the teacher and student feedback. Finally, they finalized the teacher, and students gave suggestions through feedback to develop the teaching-learning.

6. Advantage and disadvantage of OER

The open educational resources are using the distance mode of education and formal method of the teaching-learning process. The teacher can use it anytime and anyplace to download for teaching. The teacher can refer and teach from various open online materials (audio, video, text, image) (Annand and Jensen, 2017). It has utilized with a large number of the group also. These materials help the teaching-learning process (Guilbaud and Whitney, 2017) accurately. Technological resources are available in the teaching-learning environment. It develops the educational process very effectively. It creates a new opportunity to establish the teaching-learning strategy in the modern education system (Orey and Rosa, 2018). Everyone can freely practice with the help of open educational resources. The free educational materials can be reusable. The online-based educational materials create the situation for collaborative study. The open educational materials had utilized to learn with costless and enormous quality educational resources available in the repositories (Gordillo *et al.*, 2020).

The network is more critical to getting open educational resources. But most of the schools did not have proper infrastructures. People's poverty line to get an education is a dream because they don't have quality mobile and electronic things. Open educational resources are easily accessible, but at the same time, they needed the proper infrastructure (Kim *et al.*, 2007). Regular internet users are the highest performance compares with irregular internet users. This difference is affecting the equity educational system (Orey and Rosa, 2018). Improve the quality of open educational resources is difficult. In the current research, a survey said that most of the Indian school system doesn't have an efficient infrastructure. Many of the students don't have mobile or laptop for learning through open educational resources. The teachers and the learners are facing five significant hurdles to practice OER: lack of management/ foundation help; lack of scientific instrument for distributing and using resources; lack of OER practiser' expertise and time duration; lack of originality or standard of the resources; and individual problems such as lack of confidence and time duration (Ehlers, 2011).

7. Application of Open Educational Resources (OER)

OER are the online mode of educational materials, which enrich the online education process in mathematics**.** The online learning process had linked between the teachers and students in mathematics (Orey and Rosa, 2018). The distance mode of the academic operation depends on nature (Thorpe, 1997). The educational process's online method is the collection of visual, pictures, text, and audio. The open educational resources formed to contact the program but primarily created the distance mode of education. It encourages learners to get knowledge. The teaching-learning mathematics is different from the traditional method of teaching (Shepherd and van de Sande, 2014). An available educational resource is creating a situation of the individual practices.

8. Discussions and implementing areas of Open Educational Resources (OER)

The Covid-19 pandemic and lockdown have questioned the education of Refugees, traveled laborers, and their children. OER and OEP are a sustainable and constant education system in the future, even in a virus outbreak, storm, flood, and world war. These open, accessible, and quickly available free education resources give students the spirit and opportunity of learning. The institutional, legal, cultural, technical, and individual opportunities and barriers toward broader acceptance, usage, re-usage, and OER creation should be more deeply researched, especially in mathematics education, including scholars in all scientific fields and more public universities.

9. Conclusion and future work

The comprehensive study finds that the university is necessary for research scholars getting research ideas from open educational resources free of cost. Most of the research scholars are very much interested in using available educational resources. An open educational resource is the central part of the researcher getting knowledge, but it is not a traditional and formal method in India. After Covid-19 pandemic situations, peoples realize the importance of open educational resources. The universities are concentrating on introducing open educational programs on their university's official website home page itself. The developed countries are already used in open educational resources effectively. The developing countries also introduce open educational resources, but they struggle to get enough infrastructure and network facilities. Future studies could determine whether utilizing open educational resources has a reliably significant result on learners getting and using the material for mathematical education. It is feasible that most learners don't obtain the proper, needed, and suggested resources for mathematics due to the accessible price of educational resources.

Abbreviations

OER: Open Educational Resources

OEP: Open Educational Practices

ICT: Information and Communications Technology

MOOCs: Massive Open Online Courses

WWW: World Wide Web

Conflicts of interests

The authors have no conflict of interest to declare

Contributions

Each author contributed evenly to this paper. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to privacy reasons but are available from the corresponding author on reasonable request.

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