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Résumé de l'article

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Bibliometric Insights Into the Open Education Landscape

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Abstract

This bibliometric analysis explores the rapidly growing field of open education, offering insight into its nature and the wide range of academic topics it covers. This study applies co-citation and co-word analyses approach to critically review 402 publications from the Web of Science database. The aim is to identify emerging topics, seminal works, and dominant trends in the literature on open education. The co-citation analysis identifies key publications and thematic clusters that define the field, including discussions on pedagogical innovations, equity and accessibility, quality assurance, and the global impact of open educational practices (OEP). Co-word analysis, on the other hand, highlights the recurrent and emerging keywords within the literature, revealing focal points such as digital transformation in education, the role of massive open online courses (MOOCs), and the significance of open educational resources (OER) in fostering inclusive and equitable learning environments. This study stands out for its quantitative approach in mapping the current academic conditions of open education, offering insights into the dynamic interplay between technology, policy, and pedagogy. It emphasizes the need for a collaborative, inclusive approach to education, employing open educational resources and methods to fulfill the different needs of learners globally. Through this analysis, the study contributes to a deeper understanding of the current state and future directions of open education, advocating for policies and practices that support sustainable, accessible, and high-quality educational experiences.

Keywords: open education, bibliometric analysis, Web of Science, education policy

Introduction

Open education, as defined by Cunha et al. (2020), is a revolutionary trend in modern education, altering traditional learning frameworks and providing superior access to knowledge resources. This approach to learning includes a range of practices, including open educational resources (OER), massive open online courses (MOOCs), open textbooks, and open-access journals, all of which aim to democratize education by making it more accessible and affordable (Mishra et al., 2022; Stracke et al., 2019; Weller, 2020). The current state of open education is marked by its rapid expansion and increasing adoption across the world, propelled by the digital revolution. The principles of inclusivity, affordability, and collaboration are at its core, facilitating the provision of high-quality educational materials to a global audience, irrespective of their geographical location or socioeconomic status (Croft & Brown, 2020; Gunawardena, 2020). This movement has not only altered how educational content is created and shared but also prompted the rebuilding of pedagogical methods, assessment techniques, and the nature of knowledge itself, fostering a more connected and interactive global learning community (Zhang et al., 2019).

However, despite the widespread recognition of open education's importance, limited comprehensive research addresses its full scope. While numerous studies have examined specific aspects, such as OER and MOOCs, there remains a need for work that critically engages with the broader framework of open education. Recent studies have pointed to this gap. For instance, Clinton-Lisell et al. (2023) proposed the SCOPE framework for organizing research on open education, emphasizing social justice, cost, outcomes, perceptions, and engagement. This framework underscores the need for a more structured research inquiry to cover the broad aspects of open education. Zawacki-Richter et al. (2020) also highlighted the importance of examining specific elements like MOOCs and OER and the macro, meso, and micro levels of open educational practices (OEP). Similarly, Shareefa et al. (2023) found in a comprehensive metasynthesis that the limited scope of prior reviews inhibits the full understanding of the concept, further emphasizing the need for more inclusive research efforts. Iniesto et al. (2021) focused on inclusivity and sustainability in open education, pointing to challenges like insufficient accessibility standards and the need for frameworks like Universal Design for Learning. These papers underscore the pressing need for broader research beyond isolated elements to consider the entire ecosystem of open education.

This study aims to address two critical questions:

1. What are the key trends and emerging areas in open education?

2. How can these findings inform policy and practice to promote more equitable access to educational resources?

These questions are essential as the literature often presents fragmented views, lacking a holistic perspective on how different elements of open education interact to shape learning outcomes and accessibility. By engaging with the existing body of research, this paper critiques and builds upon previous findings to offer a more integrated understanding of the field.

However, despite substantial progress in the field of open education, some gaps and obstacles remain. One of the main issues is the uneven adoption and implementation of OEP across different regions and

institutions, leading to disparities in access and quality (Gangathulasi et al., 2023). According to UNESCO (2023), only about 10% of schools in sub-Saharan Africa have access to the internet, compared to nearly 90% in western Europe and North America. This digital divide directly impacts the accessibility of OER, leading to disparities in the quality of education. Moreover, a lack of awareness and understanding about OER among educators in less developed regions further exacerbates this issue, preventing the full realization of open education's potential to democratize learning (Farrow et al., 2023). Meanwhile, in the past 5 years, there have been investigations into the theme of open education, with some scholars using bibliometric methods for their research. For instance, Irwanto et al. (2023) explored the expansion of MOOCs in higher education, while Tlili et al. (2022) focused on the challenges and opportunities of OER in Africa, highlighting regional disparities. Mishra et al. (2022) offered a bibliometric examination of OER trends and patterns. However, the majority of these studies focus only on specific aspects. Our research fills this gap by providing a more comprehensive analysis of the open education landscape, assessing multiple dimensions, and offering critical insights into the trends and challenges within the field.

This study seeks to identify significant publications, thematic patterns, and pedagogy developments within the entire field of open education. Therefore, there is a pressing need for comprehensive research that extends beyond the analysis of OER and MOOCs to include other crucial elements of open education, like open-access journals and open textbooks, as well as the ongoing discussions surrounding pedagogy, assessment, and knowledge creation. These discussions highlight the necessity for a deeper understanding of OEP, emphasizing how they can be customized and implemented to address the varied needs and contexts of learners effectively.

To fill these gaps, this research employs bibliometric analysis as an effective instrument to uncover a wider insight that can guide the future direction of open education. This paper proposes to use co-citation and co-word analyses to filter through the vast literature on open education, to find key publications, determine theme trends, and trace recent developments in the field. By mapping the academic context of open education, this study aims to bring insight into the primary contributors, intellectual clusters, and developing concerns, providing a thorough assessment of current and future developments. Such an analysis is critical in providing policymakers and educational stakeholders with the data they need to make informed decisions. Through this approach, the paper hopes to contribute to the democratization of education, ensuring that learning materials and experiences are accessible to all, thus fostering a more inclusive, equitable, and collaborative educational environment.

Literature Review

The exploration of open education in recent years has taken place across multiple topics, each adding distinctively to our collective understanding and defining the course of this educational trend. As we delve further into these topics, the demand for a bibliometric study becomes evident to map the field and critically address the gaps left by previous research. While existing studies provide fragmented insights, they often need a comprehensive critique or synthesis that would allow for a more unified understanding of the complex interactions within the field of open education. This study aims to address this gap by offering a more cohesive and critical evaluation of the literature.

Pedagogical Innovations and Learning Design

At the heart of open education lies the quest for innovative pedagogical strategies and learning designs that meet the needs of the digital age. Kim et al. (2020) focus on user engagement within OER platforms, linking active participation to lower attrition rates, suggesting that pedagogical designs must prioritize keeping learners engaged. However, merely focusing on engagement overlooks the complexities of sustaining that engagement over time and across diverse learner groups. Ramirez-Montoya (2020) expands the discourse to the broader challenges of integrating educational innovations in open education. This implies that engagement alone is insufficient; pedagogical models' adaptability and flexibility are crucial for long-term success. Yet, while these studies highlight innovative strategies, they often need to address how such innovations can be universally applied or sustained, leaving critical questions about scalability and inclusivity unanswered. Zawacki-Richter et al. (2020) call for further research into open education's pedagogical aspects, hinting at innovative educational practices' complexity and unexplored potential. This lack of comprehensive critique leaves a gap in understanding how to balance innovation with practicality in educational design effectively. These studies form a learner-centric narrative that highlights the importance of engagement and innovative pedagogy in reducing dropout rates and stresses the need for these pedagogical strategies to be sustainable and adaptable in OEP.

Quality Assurance and Sustainability

Ensuring the quality and sustainability of open educational resources and practices is important. Luo and Ye (2021) explore the quality of language MOOCs through learners' perspectives, identifying key criteria that contribute to their effectiveness. While this study emphasizes the importance of meeting learners' needs and expectations, it falls short of critiquing how these criteria can be universally applied across different contexts or languages, limiting its broader application. Poce et al. (2020) assess MOOC users' experiences within a virtual mobility project, aiming to enhance quality through preliminary feedback. Their focus on user experience as a quality indicator suggests that continuous improvement and adaptability are essential for sustaining MOOC quality. However, such frameworks often neglect the challenges of maintaining consistent quality across diverse platforms and regions, especially in underresourced areas. Shah et al. (2023) introduce a framework for the formative evaluation of MOOC pedagogy, highlighting the need for MOOCs to be designed and evaluated with the learner in mind for educational efficacy. Although valuable, many of these studies do not fully explore the complexities of maintaining sustainability in resource-constrained environments, leaving the long-term quality assurance issue insufficiently addressed. These studies reveal a shared emphasis on the learner's experience as a crucial quality measure in MOOCs but underscore the necessity of deeper investigation into how these learner-centric strategies can be adapted globally and sustainably.

Global Perspectives: Diverse Challenges and Unified Solutions

The worldwide breadth of open education presents an assortment of challenges and opportunities. Bali et al. (2020) advocate for framing OEP within a social justice perspective, emphasizing the potential of OEP to address inequalities in education globally. While this perspective is commendable, it often lacks practical strategies for addressing the deep-seated systemic barriers that prevent equitable access, particularly in regions with severe infrastructural challenges. Wolfenden and Adinolfi (2019) investigate the localization of OER for teacher development, emphasizing the importance of enabling educators to adapt resources to

their contexts, thus boosting agency. While localization is essential, there is limited discussion on how these localized practices can be scaled or integrated into broader, global frameworks of open education. As a result, solving global educational difficulties through OEP involves a two-pronged approach: pushing for social justice to ensure fair access and empowering local educators to personalize educational resources to their specific teaching and learning settings. However, the literature often lacks a critical exploration of how these dual objectives—global equity and local agency—can be harmonized to produce scalable, long-term solutions.

In summary, the diverse nature of open education research, from pedagogical innovations to policy implications, forms the bedrock of our bibliometric analysis. However, a critical gap remains in the literature's ability to link these distinct areas to offer universal solutions cohesively. While existing studies provide valuable insights, they often need to address the interconnectedness of pedagogical, technological, and policy-oriented solutions, leading to fragmented knowledge. Therefore, our research synthesizes these findings and proposes cohesive models of digital pedagogy and effective strategies for bridging the digital divide, ensuring the sustainability of resources and identifying universal solutions to global challenges in open education. Through this approach, we aim to contribute to a more comprehensive and practical understanding of open education, equipping policymakers and educators with the tools they need to foster inclusivity, adaptability, and long-term sustainability.

Present Study

The primary goal of this study is to conduct a comprehensive exploration of the scholarly literature within the open education domain. Using a two-pronged bibliometric analysis, this study thoroughly assesses the entire literature on open education. It seeks to fill knowledge gaps by clarifying current and future research directions in open education. This study aims to

- examine the past and current trends in open education through co-citation analysis, and
- spot future trends in the field of open education through co-word analysis.

Methods

Bibliometric Approach

Bibliometric research analyzes and measures the influence of academic publications using a quantitative examination of scientific literature (Wider et al., 2024a), analyzing many aspects of research output using statistical approaches, such as the number of publications, citations, and patterns of collaboration, among other things (Zhang et al., 2024). Bibliometric analysis can locate developing themes, key texts, and trends in particular academic fields (Yang et al., 2024). Bibliometric research, including co-citation and co-word analyses, is a useful tool for evaluating and understanding the development of research fields and spotting possible growth areas or future directions within a specific subject (Wider et al., 2024b).

The foundation of co-citation analysis is that if two publications are often referenced together, their contents are probably connected (Bronk et al., 2023). With the help of this method, one may discover the structure of the body of scientific literature in a certain field of study as well as the most significant publications and authors in a given field of study (Ali et al., 2022). Co-word analysis, on the other hand, is concerned with the co-occurrence of keywords in scientific publications. It can highlight the prevalent themes and links within a specific research subject by detecting commonly occurring phrases (Chandrakumar et al., 2024). Additionally, it can forecast a study area's future course, giving a glance into its development (Mejia et al., 2021). Therefore, co-word analysis can be used to assess a topic's future tendencies (Zhao et al., 2024).

Data Screening and Data Collection

This study used a rigorous search method in the Web of Science (WoS) database to thoroughly evaluate the vast academic literature on open education. The WoS database is esteemed for its extensive scope and high quality, rendering it suitable for bibliometric analyses (Yan & Zhiping, 2023). It comprehensively represents important global research (Martín-Martín et al., 2021). The search was conducted in September 2023 and was carefully designed to cover all academic literature on open education, ensuring that all relevant research up to that point was included. The keyword "Open Education" was exclusively employed in the "TOPIC" search field, a deliberate decision to hone the process on publications directly relevant to this field. The "TOPIC" field was selected for its comprehensive inclusion criteria, ensuring the capture of instances where "Open Education" appeared in the publication title, abstract, or keywords. This approach cast a broad net to include all relevant research outputs. The study also included all research areas to capture the diverse character of open education research. Notably, the study did not limit the document type, including various forms of scholarly outputs such as articles, reviews, conference proceedings, and book chapters. Adopting this inclusive strategy aims to enhance the bibliometric evaluation by thoroughly studying original research contributions, reviews, and other academic discussions.

The inclusion criteria were established to ensure a comprehensive yet focused selection of literature. We included articles that (a) specifically addressed topics related to open education, (b) were peer-reviewed or underwent a formal editorial review process, and (c) were published in the English language. We considered various document types, including articles, reviews, conference proceedings, and book chapters, to provide a comprehensive view of empirical studies and theoretical discussions. This inclusivity aimed to capture the diverse nature of open education research. However, we excluded publications that (a) were outside the scope of open education, such as general discussions on educational policy without a clear focus on openness, and (b) were non-English due to accessibility constraints. To ensure the reliability of the analysis, several measures were taken: (a) a team of researchers independently screened the initial set of articles retrieved from the search, ensuring consistency and agreement in applying the inclusion and exclusion criteria; (b) in cases where disagreements occurred during the screening process, a third reviewer was consulted to resolve discrepancies, ensuring unbiased selection; and (c) a pilot analysis of the selected studies was conducted to confirm the relevance and consistency of the data before proceeding with the full bibliometric analysis.

This exhaustive search strategy retained a final set of 402 articles, which formed the basis of our bibliometric analysis. By integrating a thorough and structured inclusion and exclusion process and

employing reliability measures, we ensured that the analysis provided a robust and accurate mapping of the academic landscape of open education research. We utilized version 1.6.18 of the VOSviewer software to conduct our data analysis.

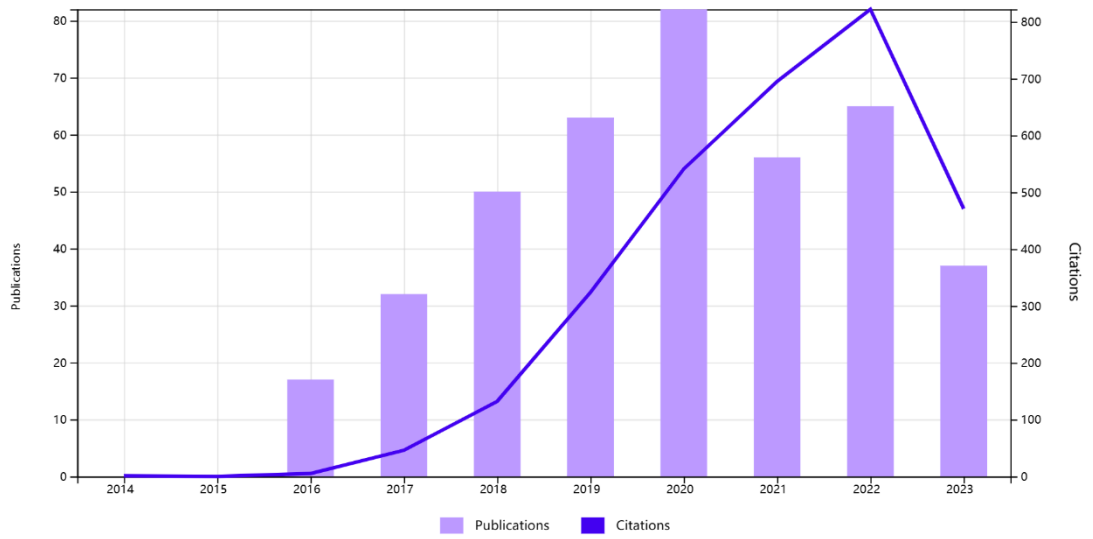
Result and Discussion

Trends in Publication and Descriptive Analysis

For the selected articles (N = 402), the WoS database produced 3,041 citations, of which 329 were self-citations. The average number of citations per article was 7.56, and the H-index was 27. The 402 articles show that open education research is gaining popularity. There were no publications prior to 2015, but significant contributions started to appear in 2016. Since then, publications have grown steadily in number. There were 82 publications in 2020, meaning there were more publications in 2020 than there were in 2016. The number of articles, however, quickly fell to 56 in 2021, indicating specific changes that occurred over this time. Up to 2022, more academic studies about open education were cited. The number of publications published and the number of citations received from 2014 to 2023 are shown in Figure 1.

Figure 1

Number of Publications and Citations Between 2014 and September 2023



Co-Citation Analysis

The citation threshold was set at 9 for the co-citation analysis, yielding 57 cited references. Figure 2 shows a network analysis resulting from the sources provided. Table 1 lists the top 10 co-cited references with the highest overall link strength.

Figure 2

Co-Citation Analysis (VOSviewer Visualization)

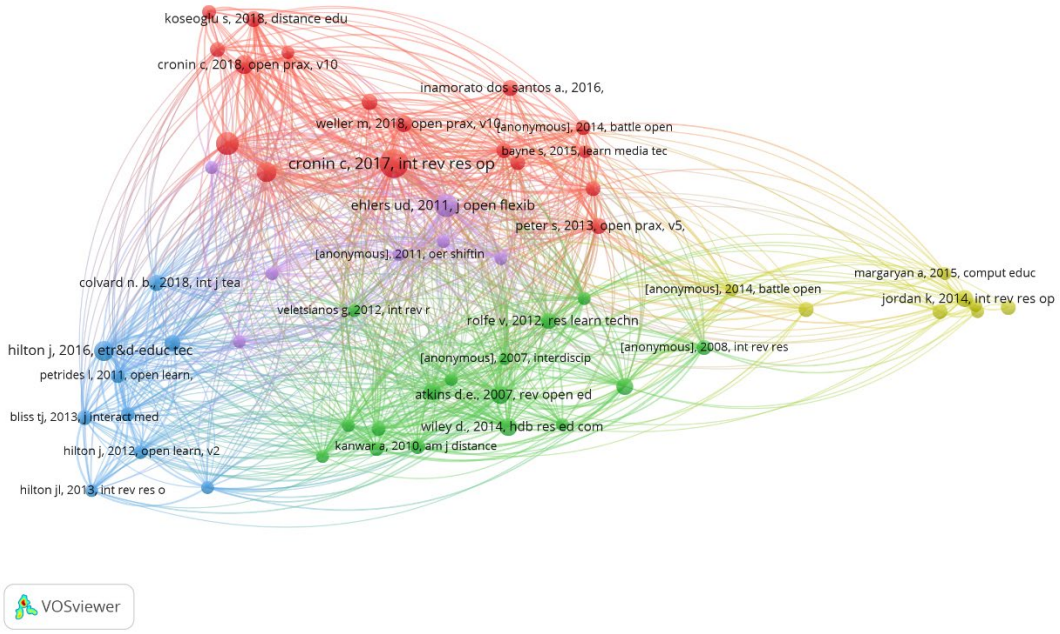


Table 1

Top 10 Documents in Terms of Co-Citation and Total Link Strength

No.	Documents	Citation	Total link strength
1	Cronin, C. (2017). Openness and praxis: Exploring the use of open educational practices in higher education. *International Review of Research in Open and Distributed Learning*, *18*(5), 15–34.	46	228
2	Ehlers, U. D. (2011). Extending the territory: From open educational resources to open educational practices. *Journal of Open, Flexible and Distance Learning*, *15*(2), 1–10.	28	165
3	Wiley, D., & Hilton, J. L., III. (2018). Defining OER-enabled pedagogy. *The International Review of Research in Open and Distributed Learning*, *19*(4).	28	122
4	Hilton, J. (2016). Open educational resources and college textbook choices: A review of research on	23	86

No.	Documents	Citation	Total link strength
	efficacy and perceptions. *Educational Technology Research and Development*, *64*, 573–590.		
5	Hegarty, B. (2015). Attributes of open pedagogy: A model for using open educational resources. *Educational Technology*, 3–13.	22	121
6	Cronin, C., & MacLaren, I. (2018). Conceptualising OEP: A review of theoretical and empirical literature in open educational practices. *Open Praxis*, *10*(2), 127–143.	20	109
7	Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). *A review of the open educational resources (OER) movement: Achievements, challenges, and new opportunities* (Vol. 164). Mountain View: Creative Common.	19	110
8	Wiley, D., Bliss, T. J., & McEwen, M. (2014). Open educational resources: A review of the literature. *Handbook of Research on Educational Communications and Technology*, 781–789.	18	79
9	Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *International Review of Research in Open and Distributed Learning*, *15*(1), 133–160.	16	26
10	Weller, M., Jordan, K., DeVries, I., & Rolfe, V. (2018). Mapping the open education landscape: Citation network analysis of historical open and distance education research. *Open Praxis*, *10*(2), 109–126.	16	87

The co-citation analysis identified five distinct clusters, each representing a unique topic within the field of open education. These clusters provide a thematic structure for understanding the key research areas and offer insights into open education's evolution and current state. Below is a detailed description of each cluster and a critical discussion of its contributions and limitations.

Cluster 1 (Red): Evolving Open Education (17 Publications)

This cluster forms a comprehensive exploration of the "Evolving Open Education" theme, with a focus on the transition from OER to OEP. The literature underscores a pivotal shift in the field, moving from access to resources to a more nuanced understanding of pedagogy, technology, and social justice within education. While Wiley and Hilton III (2018) lay a firm foundation with the concept of OER-enabled pedagogy, many of the subsequent studies (Peter & Deimann, 2013; Weller et al., 2018) offer historical and conceptual analyses without fully addressing the challenges of practical implementation. Lambert (2018) and Bali et al. (2020) align open education with social justice, emphasizing equity and access. However, despite the promising discourse on social justice, there is a lack of empirical research that explores how these

frameworks are applied in diverse educational contexts, particularly in underresourced regions. This body of work reflects a transition in open education, but the focus remains largely theoretical, with limited practical exploration of how to operationalize openness in real-world educational settings. Therefore, while this cluster provides a rich conceptual foundation, it calls for further empirical investigation to bridge the gap between theory and practice.

Cluster 2 (Green): OER's Role in Education (16 Publications)

The second cluster delves into the role of OER in education, tracing its evolution from initial enthusiasm about access to a more critical debate on its broader implications. Early works, such as Atkins et al. (2007), celebrated the democratizing potential of OER. Still, the narrative has since shifted toward questioning OER's sustainability and practical integration within institutional cultures. Studies like those by Wiley (2014) and Cox and Trotter (2016) critique the gap between OER's theoretical potential and its real-world implementation, particularly regarding institutional support and faculty engagement. Kanwar et al. (2010) and Rolfe (2012) explore the economic and pedagogical barriers to OER adoption, particularly in the Global South, where infrastructural limitations often impede its success. While these studies provide valuable insights, they stop short of offering actionable solutions for overcoming these barriers, leaving a gap in the literature regarding practical strategies for scaling OER in diverse contexts. This cluster emphasizes the need for a more strategic and thoughtful integration of OER into pedagogical practices, moving beyond theoretical discussions to address the real-world challenges of sustainability and scalability.

Cluster 3 (Blue): Adoption of Open Education (9 Publications)

The third cluster focuses on the adoption and impact of open education across various educational levels. Research in this cluster highlights the cost-saving benefits and positive effects on student success metrics, particularly in terms of textbook affordability and improved learning outcomes (Bliss et al., 2013; Colvard et al., 2018; Petrides et al., 2011). However, while the literature provides ample evidence of the financial benefits of open education, it often needs a critical analysis of how these benefits translate into long-term educational outcomes. Faculty and student perceptions of open education are generally positive. Still, there needs to be more exploration of the challenges and resistance to adoption, particularly from faculty who may be hesitant to change established teaching practices (Hilton, 2016). This body of research makes a compelling case for the broader adoption of open education, but it would benefit from a more critical examination of the institutional and cultural factors that influence adoption, particularly in regions with less established open education frameworks.

Cluster 4 (Yellow): Educational Paradigms of MOOCs (8 Publications)

Cluster 4 focuses on MOOCs and the educational paradigms that underpin them. The literature draws on foundational theories of learning, such as Vygotsky's (1978) social construction of knowledge, to analyze the effectiveness of MOOCs in fostering learning. While Vygotsky's theories provide a solid theoretical framework, the practical challenges of applying these paradigms in massive, often impersonal online environments remain underexplored. Margaryan et al. (2015), Liyanagunawardena et al. (2013), and Jordan (2014) examine the instructional quality and enrollment patterns of MOOCs, but there is a recurring critique that MOOCs often fail to live up to their democratizing potential, with high dropout rates and limited engagement from learners. MacDonald (2015) raises important questions about the paradox of "openness" in MOOCs, highlighting the tension between the promise of accessible education and the reality

of low completion rates and limited interaction. This cluster suggests that while MOOCs offer innovative educational opportunities, their success is hindered by challenges related to learner engagement and the scalability of pedagogical approaches.

Cluster 5 (Purple): Implementation of OEP (7 Publications)

The final cluster addresses the implementation of OEP, emphasizing a shift from using open resources to fostering participatory, collaborative learning environments. Early works by Ehlers (2011) and Lane and McAndrew (2010) pioneered the change toward open practices. However, more studies highlight the practical challenges of embedding these practices into everyday teaching (Jhangiani et al., 2016; Paskevicius, 2017). Research in this cluster reveals a growing interest in how open pedagogy can transform educational experiences, but it also identifies significant barriers, such as faculty resistance, lack of institutional support, and insufficient training in open practices (Andrade et al., 2011; Kaatrakoski et al., 2017). While the literature provides valuable frameworks for understanding OEP, there is a need for more empirical research that evaluates the long-term impact of these practices on teaching and learning outcomes. This cluster emphasizes moving beyond resource-oriented approaches to foster deeper engagement with open educational philosophies. However, more research is needed to overcome the practical barriers to OEP implementation.

Table 2 summarizes the co-citation analysis conducted on open education research. The table provides information on cluster labels, publication counts, and representative articles.

Table 2

Co-Citation Clusters on Open Education

Cluster	Cluster label	Number of publications	Representative publications
1 (Red)	Evolving open education	17	Wiley and Hilton (2018); Peter and Deimann (2013); Hegarty (2015); Knox (2013); Bayne (2015); Nascimbeni and Burgos (2016); Lambert (2018); dos Santos et al. (2016)
2 (Green)	OER's role in education	16	Tuomi (2013); Rolfe (2012); Mishra (2017); Kanwar et al. (2010); D'Antoni (2009); Cox and Trotter (2016); Atkins et al. (2007)
3 (Blue)	Adoption of open education	9	Bliss et al. (2013); Fischer et al. (2015); Hilton (2016); Petrides et al. (2011)
4 (Yellow)	Educational paradigms of MOOCs	8	Jordan (2014); Margaryan et al. (2015); Liyanagunawardena et al. (2013); Vygotsky and Cole (1978); Braun and Clarke (2006); Daniel (2012)
5 (Purple)	Implementation of OEP	7	Ehlers (2011); Andrade et al. (2011); Beetham et al. (2012); Kaatrakoski et al.

Cluster	Cluster label	Number of publications	Representative publications
			(2017); Jhangiani et al. (2016); Lane and McAndrew (2010); Paskevicius (2017)

Note. Author's interpretation derived from VOSviewer analysis. OER = Open Educational Resources; MOOCs = Massive Open Online Courses; OEP = Open Educational Practices.

Co-Occurrence of Keyword

There were at least seven occurrences of each of the 49 keywords discovered. According to the co-word analysis, the most frequently used keyword was "Open education" (182 occurrences), followed by "Open educational resources" (63 occurrences) and "OER" (46 occurrences). Table 3 displays the top 15 co-occurring keywords within this study domain.

Table 3

The 15 Most Frequent Keywords in the Keyword Co-Occurrence Analysis

Rank	Keyword	Occurrences	Total link strength
1	Open education	182	369
2	Open educational resources	63	156
3	OER	46	144
4	Higher education	48	133
5	MOOCs	41	96
6	Open educational practices	23	70
7	Open pedagogy	18	68
8	Education	31	62
9	Students	21	59
10	Online learning	21	58
11	Quality	13	56
12	Impact	14	52
13	Teachers	13	50
14	Technology	17	49
15	Distance education	22	48

Note. OER = Open Educational Resources; MOOCs = Massive Open Online Courses.

The co-word analysis identified five interconnected clusters, each offering insights into emerging trends and future directions for research in open education. These clusters point to key areas where more in-depth exploration is needed to address unresolved challenges and leverage the full potential of OEP.

Cluster 1 (Red): Blended Learning in Open Education

This cluster, consisting of 12 keywords, focuses on "Blended Learning in Open Education," which integrates digital technology into traditional pedagogical models. While blended learning has been widely acknowledged for its potential to cater to diverse learning needs, a critical gap in the literature lies in understanding the scalability and quality assurance mechanisms needed to ensure consistent educational outcomes across varied contexts (Ngoasong, 2022). Future research will likely explore these challenges, particularly in underresourced regions, where infrastructure limitations may hinder implementing blended models effectively. Additionally, there is a need to examine how blended learning can be adapted to ensure equity, as Chohan and Hu (2022) suggest that digital inclusion remains a significant barrier. The anticipated research will also focus on enhancing the design of MOOCs to address persistently high dropout rates and improve engagement, ensuring that learners benefit from personalized and flexible approaches (Bettiol et al., 2022). The findings in this cluster suggest that blended learning offers great promise for democratizing education. However, without a deeper understanding of how to maintain engagement and quality in diverse educational environments, the full potential of blended models may remain unrealized.

Cluster 2 (Green): Openness in the COVID-19 Era

This cluster, comprising 11 keywords, addresses "Openness in the COVID-19 Era," with the pandemic serving as a catalyst for the rapid adoption of OEP. The global shift to remote learning during the pandemic exposed opportunities and challenges for open education, highlighting the urgent need for research into how these innovations can be sustained post-crisis (Assaf & Gan, 2021). While OER proved to be vital in ensuring continuity of learning, especially in underserved regions, future studies will likely investigate the sustainability of this shift and the infrastructural gaps that need to be addressed (Sangster et al., 2020). The pandemic also elevated the role of open science in addressing global challenges. However, there is a need to explore how the open science model can continue to foster collaboration beyond crisis contexts (Calder et al., 2022). This cluster suggests that while the pandemic created an immediate need for open resources, the long-term challenge will be ensuring that these resources remain integrated into educational systems in ways that promote resilience and adaptability. Future research may focus on strategies to institutionalize these open practices to build a more accessible and flexible education system that can withstand future disruptions (Farsawang & Songkram, 2023).

Cluster 3 (Blue): Challenges of OER Adoption

The "Challenges of OER Adoption" cluster, with 11 keywords, underscores the barriers to effectively integrating OER into educational frameworks. While much of the literature celebrates the potential cost-saving and accessibility benefits of OER, there remains a critical gap in understanding how institutional and cultural factors influence adoption, particularly regarding faculty resistance and institutional support (Kauffman, 2021). Predictions for future research suggest a growing focus on developing models that address these barriers, with attention to creating incentives for faculty adoption and aligning OER initiatives with institutional priorities. Furthermore, the need for sustainable funding and long-term planning for OER initiatives remains underexplored, especially in regions with limited educational budgets (Gong, 2024; McGowan, 2020). Future research will aim to uncover practical strategies for scaling OER adoption and developing open textbooks and other resources that can be maintained over time (Tlili et al.,

2023). The cluster suggests that addressing these adoption challenges will be crucial for OER to fulfill its promise of improving educational access and equity.

Cluster 4 (Yellow): Inclusive Digital Pedagogy

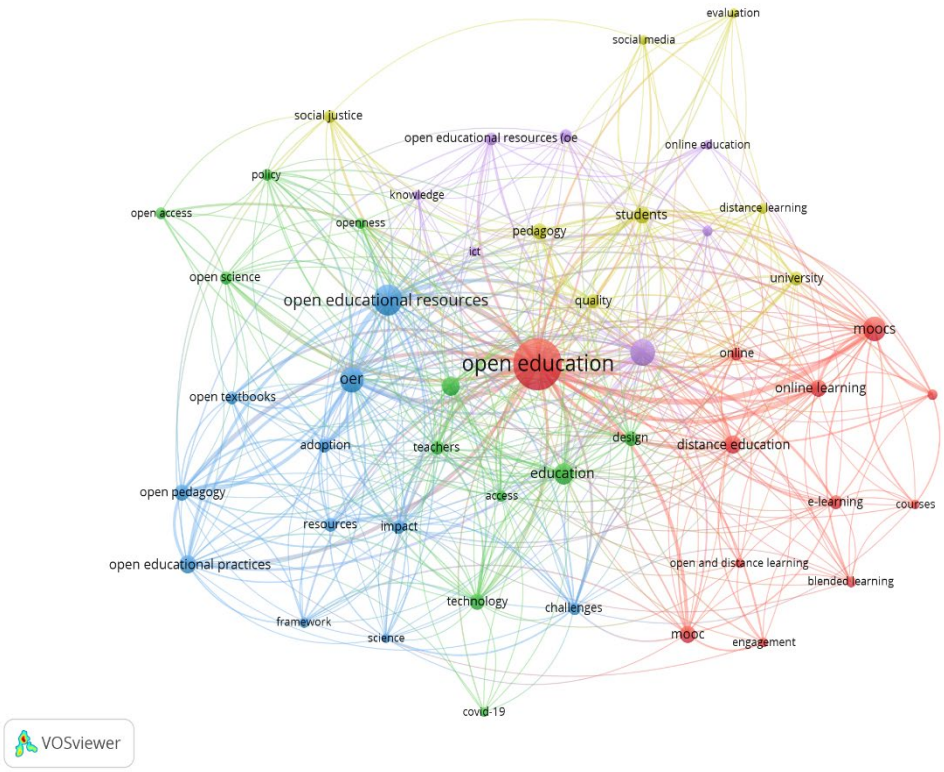
The eight keywords in this cluster emphasize "Inclusive Digital Pedagogy," a theme that reflects the shift toward digital learning models in higher education. While digital pedagogy can potentially increase inclusivity, especially for marginalized students, more empirical research is still needed on how these tools are implemented to reduce inequalities (Laufer et al., 2021). Future research will likely evaluate digital platforms' effectiveness in creating equitable learning environments and minimizing the digital divide. The role of social media and other digital platforms in supporting interaction and collaboration within inclusive pedagogical frameworks will likely be a focus of future studies (O'Dwyer et al., 2023). The findings suggest that digital pedagogy can support more equitable learning opportunities but only if the design and implementation of these platforms actively work to reduce disparities rather than exacerbate them. This area of research will need to examine how digital tools can be adapted to different socioeconomic contexts to ensure that all learners benefit from high-quality education.

Cluster 5 (Purple): Collaborative Online Academia

The "Collaborative Online Academia" cluster, comprising seven keywords, points to the growing role of collaboration in online learning environments facilitated by OER and Information and Communication Technology (ICT). While collaborative learning has the potential to enhance educational quality by breaking down geographic and institutional barriers, future research will need to explore how such collaboration can be sustained across diverse contexts (Huang et al., 2020). The integration of ICT into higher education is poised to become a focal point of future studies, particularly in terms of how universities can apply these tools to promote meaningful knowledge exchange and interdisciplinary collaboration (Bilan et al., 2023). Additionally, researchers will likely examine how to overcome the infrastructural and technical challenges that can limit the success of collaborative online academia, especially in regions where access to reliable technology is limited (Cui et al., 2020). The findings suggest that while the potential for collaboration through OER and ICT is clear, its realization depends on overcoming these barriers to ensure widespread participation and engagement. Figure 3 shows a network analysis resulting from the co-word analysis.

Figure 3

Co-Word Analysis of Open Education Research (Vosviewer Visualization)



The co-word analysis reveals several key areas for future research in open education. Table 4 summarizes the co-word analysis conducted on open education.

Table 4

Co-Word Analysis on Open Education

Cluster no. and color	Cluster label	Number of keywords	Representative keywords
1 (Red)	Blended learning in open education	12	"blended learning," "courses," "distance education," "e-learning," "engagement," "massive open online courses," "MOOCs," "online," "online learning," "open and distance learning," "open education"
2 (Green)	Openness in the COVID-19 era	11	"access," "COVID-19," "design," "education," "open access," "open education resources," "open science,"

Cluster no. and color	Cluster label	Number of keywords	Representative keywords
			"openness," "policy," "teachers," "technology"
3 (Blue)	Challenges of OER adoption	11	"adoption," "challenges," "framework," "impact," "OER," "open educational practices," "open educational resources," "open pedagogy," "open textbooks," "resources," "science"
4 (Yellow)	Inclusive digital pedagogy	8	"distance learning," "evaluation," "pedagogy," "quality," "social justice," "social media," "students," "university"
5 (Purple)	Collaborative online academia	7	"higher education," "open educational resources (OER)," "higher-education," "collaboration," "knowledge," "ICT," "online education"

Note. Author's interpretation derived from VOSviewer analysis. OER = Open Educational Resources.

Implications

The theoretical implications of this bibliometric analysis highlight the fluid and evolving nature of open education, as evidenced in the co-citation analysis. Open education is not a static concept but a dynamic entity, constantly adapting to emerging educational needs, technological advancements, and societal challenges. This aligns with Bozkurt et al. (2019) and Cronin (2017), who emphasized that open education frameworks are characterized by their responsiveness to the shifting landscape of global education. The continuous evolution of open education carries profound implications for educational theory, prompting a reevaluation of how knowledge is disseminated, acquired, and shared across borders and contexts. Our findings support Wiley and Hilton III (2018), who argued for a shift from merely providing access to educational resources to focusing on how these resources can be integrated into pedagogical frameworks that emphasize equity and inclusion. This intersection of pedagogy, technology, and social justice has emerged as a critical component in advancing the open education movement, demonstrating that open education can serve as a vehicle for addressing broader societal inequalities.

Our findings also shows that the OEP field's evolution aligns with current educational demands, especially in equity, accessibility, and pedagogical innovation. Previous studies have similarly highlighted the importance of this intersection. For example, Lambert (2018) and Bali et al. (2020) connected open education with social justice, emphasizing that OEP can be a powerful tool for promoting equity and democratizing knowledge. Our analysis reinforces these conclusions, suggesting that the future of open education lies in its ability to continuously adapt to changing educational demands while remaining anchored in accessibility, inclusivity, and empowerment. Thus, this study not only expands the theoretical framework around open education but also supports our aim to offer a cohesive understanding of how OEP develop and their broader implications for educators and policymakers. The study emphasizes that

educators and policymakers must continuously redefine and innovate OEP, ensuring they remain relevant in diverse global contexts.

On the practical side, this research underscores the importance of implementing and advocating for open educational resources and practices within higher education, particularly to reduce financial barriers and increase access to diverse learning resources. The co-occurrence analysis findings strongly align with prior studies' results (Bliss et al., 2013; Hilton, 2016), which similarly highlighted the financial and accessibility benefits of integrating OER into educational curricula. OER significantly reduces financial burdens on students, facilitating greater participation from underrepresented groups and democratizing access to higher education. This supports our goal of highlighting how OER can contribute to bridging the digital divide and promoting inclusivity.

Beyond financial savings, the flexibility offered by OER allows students to access learning materials at their convenience, promoting personalized learning paths that cater to individual schedules and learning styles. This flexibility, as noted by Wiley (2014), is one of the critical advantages of OER, enabling students to tailor their learning experience to their specific needs, thus fostering greater engagement and retention. The adaptability of OER enhances learning outcomes and empowers students by providing them with the autonomy to control their learning process. However, as our research and earlier studies (Cox & Trotter, 2016; Rolfe, 2012) suggest, the successful implementation of OER is not without challenges. Faculty acceptance and institutional support play pivotal roles in effectively adopting open resources. Faculty reluctance to adopt OER is a significant challenge, often stemming from concerns about quality, lack of familiarity, and the absence of institutional incentives. Our findings echo these concerns, suggesting that without comprehensive faculty development programs and institutional policies that incentivize OER adoption, the potential of open education to transform learning environments may be limited. This aligns with the work of Paskevicius (2017), who emphasized that faculty development and support are essential to overcoming barriers to OER adoption, particularly regarding pedagogical innovation and integration into existing curricula.

Institutions must actively foster a culture of openness by providing educators with the necessary tools, training, and incentives to adopt OER. This point is also supported by Jhangiani et al. (2016), who argued that institutional policy changes are critical for ensuring that OER becomes a mainstream component of educational delivery. Our analysis suggests that such institutional efforts are crucial for OER initiatives' long-term success and sustainability, particularly as the demand for flexible and accessible educational resources continues to grow.

Overall, the findings from this bibliometric analysis validate the insights from previous research and provide new directions for theoretical exploration and practical implementation. By comparing the current study's results with established literature, it is evident that while the advantages of OER and OEP are well-documented, significant gaps in faculty engagement and institutional support still need to be addressed. Addressing these gaps aligns with our study's aim to provide educators and policymakers with actionable insights on enhancing the effectiveness of open education initiatives.

Conclusion, Limitations, and Future Avenue

The bibliometric analysis provided a broader understanding of the diverse nature of open education, emphasizing its evolution and responsiveness to educational demands. Open education emerges from research as a dynamic and ever-evolving field (Bozkurt et al., 2023), shaped by the collaborative efforts of educators, researchers, and institutions. The practical significance of embracing OER is clear, offering substantial benefits such as cost savings, greater accessibility, and enhanced learning outcomes. OER serve as a powerful means to alleviate the financial strain on students and democratize access to quality education. Their flexibility and potential for personalization lead to richer educational experiences, aligning with modern learners' needs.

Although this review provides insightful information, it is constrained. In this review, several limitations are addressed. First, the analysis only includes sources listed in the WoS database. Other databases, such as Dimension and Scopus, may produce different outputs. Despite using only one database, WoS is thought to be the world's most dependable and robust database, ensuring that all the articles are of high caliber (Pranckute, 2021). Second, bias issues could have resulted from the qualitative interpretation of the clusters. Based on previous research in the clusters of co-citation analysis and the relationships between the keywords in the co-word analysis, the authors' examination of the clusters led to the development of this inductive approach. The science's subjective threshold value determination is still another drawback. Another drawback is the subjective selection of the threshold value in the science mapping study. The authors' interpretation was used to finalize the clusters, which could have caused bias. The cluster labels and threshold values were cross-checked among the authors to confirm their resilience and accurate representation of the knowledge structure to address both problems. Lastly, the findings may not fully account for regional or institutional variations in adopting open educational practices and resources.

Future research should take into account several options to address these limitations and improve our knowledge of open education. First, by capturing quantitative trends and qualitative views from academics, educators, and students, bibliometric analysis combined with qualitative research techniques may offer a more complete picture of the topic. To guarantee that educational practices and policies remain responsive to the shifting demands of students and educators in the digital era, it is crucial to examine how open education is continuously developing. Second, while considering regional and institutional differences, research should examine the contextual elements that affect adopting open educational practices and materials. Finally, a more delicate examination of open education's potential challenges and drawbacks would contribute to a more balanced and holistic understanding of the field. By addressing these future avenues, we can continue to promote openness, accessibility, and innovation in education.

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