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Open educational resources literacy among pre-service teachers: A scoping review of awareness, competence, and pedagogical integration

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Abstract

The present scoping review explores the status of Open Educational Resources (OER) literacy in pre-service teachers within the context of three key dimensions, which are awareness, competence, and pedagogical integration. In line with the PRISMA-ScR, an extensive search was carried out in the Scopus databases, Web of Science, ERIC, and Google Scholar to find empirical studies published in 2005 to 2025. The final review involved 45 studies following screening. The results indicate that, although pre-service educators tend to show positive attitudes to adopt OER, there are still a lot of gaps in their knowledge about Creative Commons licensing, 5R-model (retain, reuse, revise, remix, redistribute), and the actual application of open pedagogical practices. Several factors affect OER literacy, including institutional support, faculty modeling, integration of curriculum and access to professional development opportunities. It is noted in the review that there is a pressing urgency in the systematic integration of OER competencies into teacher education programmes to equip future teachers to make appropriate use of open educational practices. This review has implications on curriculum designers, teacher educators and policymakers who may want to increase the use of OER and literacy in teacher preparation programs.

Keywords: Open educational resources, OER literacy, pre-service teachers, teacher education, open pedagogy, scoping review

1. Introduction

The digital era has radically changed the face of education and Open Educational Resources (OER) have become a central tool of knowledge democratization and innovative approaches to education. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), OER can be described as teaching, learning and research resources in any format and medium that exist in the public domain or have been published under an open license that allows no-cost access, re-use, re-purposing, adaptation and redistribution (UNESCO, 2019, p. 5) ^[47]. This definition highlights the potential of OER in changing the nature of educational inequities, as well as facilitating the creation and sharing of knowledge in an interdisciplinary context across the globe.

The value of OER in modern education is further reinforced by the UNESCO Recommendation on Open Educational Resources, approved by all member states in November 2019, the first international normative instrument in the domain of openly licensed educational materials (UNESCO, 2019) ^[47]. This recommendation identifies five important lines of action: capacity building of stakeholders to create, access, reuse, adapt and redistribute OER; policy building; promotion of inclusive and equitable quality OER; supporting development of sustainability models of OER; and promoting international cooperation. These action areas offer an in-depth guide on how the complex aspects of OER implementation are approached in different education settings.

The conceptual basis of OER lies in the Wileys (2014) ^[48]

classic 5R model, where the fundamental rights that open educational resources possess are defined by the right to retain, reuse, revise, remix, and redistribute content. This framework has become central to differentiating OER among other types of free education materials, insisting that openness is more than merely the ability to access the content at no cost, and includes the legal and technical ability to engage with the content in ways that are considered transformative. The 5R framework has been popularized in terms of OER research and practice, acting as a standard to assess the openness of learning resources and to inform the creation of OER projects across the globe (Wiley, 2014; Hilton, 2016) ^[48, 17].

Teacher education programs hold a special role in the OER ecosystem, because they will train the following generation of educators who will in turn dictate the scale and quality of OER implementation in K-12 and higher education institutions. As future practitioners, pre-service teachers need not only to be aware of OER but also to be competent in terms of their ability to incorporate these resources into their teaching practices. This narrative of OER literacy involves various levels such as the capacity to find, assess, modify, create, and distribute open education materials and comprehend the legal, ethical aspects of open licensing (Kanwar *et al.*, 2011; Mishra and Kanwar 2015) ^[23, 32].

Although there is an increasing amount of literature on OER adoption in in-service teachers, comparatively less focus has been taken on learning OER literacy among pre-service teachers in their first teacher preparation. This is especially worrying considering that initial exposure to OER and open

pedagogical practices in teacher education can potentially introduce initial competencies and dispositions that remain throughout the professional lives of educators. Moreover, the distinctive conditions of teacher training, which involves both theory and field-related experience, open both opportunities and challenges in building OER literacy that are not necessarily the same as those faced by working educators.

This scoping review aims to chart the scope and nature of pre-service teacher research in relation to OER literacy, specifically in the three interrelating aspects: understanding of OER concepts and resources, the ability to use OER in effective practice, and the integration of OER as a pedagogical approach in instruction and learning processes. This review will help address gaps in the literature, guide teacher education curriculum development, and inform future research in this important area of educational technology and teacher preparation by synthesizing available existing empirical data.

2. Literature Review

2.1 Conceptualizing OER Literacy

OER literacy is a concept that goes beyond simple understanding of open educational resources to include a full range of knowledge, skills, and dispositions that are essential to successfully participate in open educational practices. Building up on the fundamentals of Kanwar *et al.*, (2011)^[23] at the Commonwealth of Learning, OER literacy could be thought of as a set of several interlinked abilities that allow an educator to find, analyze, modify, develop, and distribute educational content under open licensing conditions. This theoretical depiction is consistent with the more general discourse of digital literacy in education, which highlights not only mastery of any specific technical facilities but also critical analysis, the understanding of ethical issues, and innovative use of digital resources (Mishra and Kanwar, 2015)^[32].

As Mishra and Koehler (2006)^[31] posit in their technological pedagogical content knowledge (TPACK) framework, it is helpful to frame OER literacy in the context of teacher education. TPACK focuses on the multifaceted interrelation between technological knowledge, pedagogical knowledge, and content knowledge, and posits that the key to successful incorporation of technology into teaching and learning lies in the ability of an educator to move in-between the areas. When applied to OER literacy, this framework implies that pre-service teachers should not only acquire technical skills related to accessing and working with open resources but also acquire the pedagogical knowledge required to incorporate them into their teaching practice and not lose sight of their ability to meet the objectives of curricular content (Joo *et al.*, 2018)^[22].

2.2 Open Pedagogy and Open Educational Practices.

The difference between the notions of OER and open educational practices (OEP) is key to comprehension of the entire breadth of OER literacy. According to Ehlers (2011)^[11], open educational practices are defined as practices that facilitate (re)use and production of high-quality open educational resources via institution policy, encourage new pedagogical models, respect and empower learners as co-producers in their lifelong learning processes (p. 4). In this

definition, the emphasis is put not on the resources, but on the practices and processes in which OER are developed, consumed and shared. OEP has further developed into the concept of open pedagogies using the affordances of openness to change the relationships in teaching and learning (Cronin, 2017; Paskevicius and Irvine, 2019)^[9, 33].

The idea of OER-enabled pedagogy has been further developed by Wiley and Hilton (2018)^[49] and describes it as the collection of pedagogical strategies, which can only be available or even feasible in the circumstances of the 5R permissions unique to OER (para. 5). This conceptualization highlights that the value of OER goes beyond cost savings to include pedagogical advances possible due to the permission to retain, reuse, revise, remix, and redistribute learning resources. These innovations encompass student-created content, knowledge building, and authentic learning experiences that assign the role of knowledge creators to the learners, instead of information consumers.

2.3 OER in Teacher Education.

The studies on the OER implementation in teacher education have shown the positive trends as well as the current challenges. In a comprehensive study of professional development in OER integration among South Asian educators, Karunanayaka, Naidu, Rajendra, and Ratnayake (2015, 2018)^[25, 24] identified that, although teachers showed positive attitudes towards OER, they did not always have the technical skills and pedagogical knowledge that would help them implement it. They focused their work on the need to develop professionally in the long term, not just on creating awareness but on more practical experience with the creation and adaptation of OER and their integration.

COUP framework was created by Bliss, Robinson, Hilton, and Wiley (2013)^[20] to study four dimensions that are crucial to OER research, namely, cost, outcomes, usage, and perceptions. The framework has been utilized in various studies investigating OER adoption in a higher education environment and was a useful resource in understanding factors that impact faculty and student engagement with the open resources. In their reviews of OER literature on the topic, Hilton (2016, 2020)^[17, 18] observed that in the majority of cases, students and faculty members have a positive attitude toward OER and appreciate cost-saving opportunities, yet the pedagogical consequences of the use of these resources differ significantly and, therefore, the effectiveness of OER can largely depend on the context of implementation.

Research on pre-service teachers in particular has found that there are a number of factors that impact OER adoption and literacy growth. Peled (2021)^[35] also studied the level of digital literacy among pre-service teachers and discovered that most of them were confident in using basic technologies, but their willingness to use more advanced pedagogical tools, such as OER implementation, was significantly lesser. On the same note, an Irish study conducted by McGarr and McDonagh (2020)^[30] found that pre-service teachers joining teacher education programs typically are poorly informed about what copyright, licensing, and open educational practice are, which suggests that these topics should be explicitly taught in teacher preparation programs.

2.4 Barriers and Facilitators to OER Literacy

The sources determine several impediments to OER literacy development in the educator community, many of which are especially pertinent to the pre-service teacher setting. The findings of Appiah *et al.* (2020) ^[1] indicated that the main obstacle to the adoption of OER was the absence of awareness and training because more than 80% of the academic staff and 90% of students were not aware of the concept and resources of OER. Such results have been documented in different geographical settings, which indicates that the lack of awareness is a worldwide problem in OER adoption (Tlili *et al.*, 2022) ^[44].

The perceived effort and time that it takes to find, assess and utilize OER are major obstacles to all educators. Bond *et al.* (2024) ^[6] found that the unwillingness of faculty to embrace OER could be largely explained by the fears that such a process might become time-consuming and energy-demanding in terms of having to find the high-quality resources and modify them to fit the specific teaching settings. These fears are exacerbated among pre-service teachers who are also coping with the multi-faceted requirements of teacher preparation, such as coursework, field experiences and acquisition of fundamental pedagogical skills.

The other important impediment to OER literacy is copyright and licensing confusion. Gurav and Nagarkar, (2025) ^[16] stated that the lack of awareness concerning academic copyrights and Creative Commons licenses can be listed as one of the main issues that put a barrier to the expansion of OER usage. Bond *et al.*, (2021) ^[5] also indicated that students and faculty members usually show low and diverse awareness of copyright and open licensing issues and cannot easily work with OER. In the case of pre-service teachers, it is necessary to gain fluency with Creative Commons licenses and learn more about the legal aspects of open content to be sure and use OER ethically.

Faculty modeling and institutional support are important elements to support the development of OER literacy. Pawlyshyn, Braddlee, Casper, and Miller (2013) ^[34] showed that cross-institutional cooperation and professional development of the faculty could substantially improve the adoption of OER and student outcomes. According to their study, student success rate was higher when faculty were provided with organized assistance in integrating OER, which indicates that investment in OER professional development by an institution has some observable returns. Likewise, Arispe, Hoyer, and Haynes (2025) ^[2] discovered that teachers engaged in continuous professional development about the 5Rs of OER showed statistically significant awareness and use of open resources relative to teachers who had exposure to the least amount.

3. Methodology

3.1 Review Design

The methodology by which this scoping review was developed was that of Arksey and O'Malley (2005) ^[3] and further developed by Levac, Colquhoun, and O'Brien (2010) ^[28] which offers a systematic process of mapping out the scope and nature of research in a certain area. The review was conducted in accordance with the guidelines of PRISMA-ScR extension of Preferred Reporting Items to Systematic Reviews and Meta-analyses, which is necessary

to guarantee the transparency and replicability (Tricco *et al.*, 2018) ^[46]. Ascoaching systematic reviews, scoping reviews are intended to understand the scope, breadth, and nature of research endeavour, gaps in the literature and summarize findings in a variety of study designs and research methodologies.

3.2 Search Strategy

Four major academic databases including Scopus, Web of Science, ERIC (Education Resources Information Center), and Google Scholar were searched in terms of literature. The search strategy was a combination of keywords and controlled vocabulary terms, which addressed three conceptual domains: (1) Open Educational Resources (including the terms like the OER, open educational resources, open textbooks, open courseware), (2) pre-service teachers (including the terms like the pre-service teachers, student teachers, teacher candidates, pedagogical integration), and (3) literacy and competence (including the terms like the literacy, competence, awareness, knowledge, skills, pedagogical integration). Search strings were modified to fit the respective search syntax requirements on each database.

This was the first database search carried out in January 2025 and additional searches were performed to find out the recently published studies. Additional studies that were not included by any of the database searches were identified in reference lists of included articles and relevant review papers, which were searched by hand. The search was narrowed down to the literature that was published in the last three years, 2013-2025, to make it relevant to the current situation of OER and capture the time frame in which OER research must develop substantially, since the adoption of open educational practices by the mainstream.

3.3 Inclusion and Exclusion Criteria

To include the studies in the research, they had to meet the following criteria: (1) they had to focus on pre-service teachers or student teachers enrolled in the first or initial teacher education programs; (2) they had to address OER awareness, knowledge, skills, use, or pedagogical integration; (3) they had to be empirical research studies (quantitative or qualitative or mixed methods); (4) they had to be published in peer-reviewed journals, conference proceedings, or dissertation; and (5) to be written in the English language. The studies were filtered out on the following criteria: (1) include only in-service teachers and not much pre-service teacher; (2) investigated general educational technology or digital literacy and not OER specifically; (3) were not theoretical papers or conceptual papers; (4) were not published before 2013; (5) did not have a complete text, Data Extraction and Synthesis.

3.4 Data Extraction and Synthesis

Data were extracted using a standardized form which was meant to capture important information in each of the included studies including: author(s), year of publication, country/context, the study design, sample characteristics, theoretical framework, key findings of the OER awareness, competence and pedagogical integration, and barriers and facilitators identified. The extracted data were identified with themes to determine patterns across studies and chart

the literature in terms of three dimensions of OER literacy, awareness, competence, and pedagogical integration.

4. Results

The search strategy identified a total of 847 records across the four selected databases (Scopus, Web of Science, ERIC, and Google Scholar). After removing duplicates, titles and abstracts were screened, resulting in 68 full-text articles being assessed for eligibility. Following a rigorous application of the inclusion and exclusion criteria, 45 studies were included in the final review. These studies were published between 2013 and 2025, with the majority ($n = 34$) published from 2019 onwards, indicating a growing scholarly interest in OER literacy within teacher education. Geographically, the included studies represented diverse global contexts, including North America ($n = 14$), Europe ($n = 12$), Asia ($n = 10$), Africa ($n = 4$), and multi-national studies ($n = 5$). In terms of research design, the studies comprised quantitative surveys ($n = 19$), qualitative case studies ($n = 13$), mixed-methods studies ($n = 10$), and experimental or quasi-experimental designs ($n = 3$). The sample sizes varied considerably, ranging from small-scale qualitative studies involving 8–15 participants to large-scale surveys including more than 1,200 pre-service teachers. This diversity in methodological approaches, geographical contexts, and sample characteristics provides a comprehensive understanding of OER literacy across different teacher education settings.

4.1 Pre-service Teachers OER Awareness.

The awareness dimension of OER literacy that is analyzed in this review includes knowledge of OER concepts and open licensing, knowledge of OER repositories and platforms. The literature reviews show a rather diverse situation regarding the awareness of pre-service teachers towards OERs: it varies greatly depending on the context and programme. A number of studies established that pre-service teachers are those who have less prior exposure to the idea of OER, when they join teacher education programs. As one example, a study by Sumarni *et al.* (2023)^[40] in Paraguay concluded that final-year pre-service teachers had very basic or even basic perception of their digital competence (p. 1), such as poor knowledge of the concept of OER and open licensing. Equally, Galindo-Dominguez and Bezanilla (2021)^[14] have documented that pre-service teachers in Spain were recording medium digital competency with specific challenges in content creation and accessing open resources.

Nevertheless, research investigations carried out on pre-service teachers who had been given specific training on OER through their teacher education courses showed more favorable results. A study conducted by Torres-Hernandez and Gallego-Arrufat (2024)^[45] on 1,366 pre-service teachers in Spain revealed that the respondents had intermediate levels of digital safety competence with OER awareness being one of those areas that improved after specific training. These results imply that awareness of OER may be built successfully with the help of structured curricular interventions, but the level of awareness might be low when teacher-candidates are entering.

One of the themes that comes out constantly in the studies is the confusion between free resources and actually open

resources that have proper licensing, as to be reused and adapted. According to Colvard, Watson, and Park (2018)^[7], a significant number of educators (as well as pre-service teachers) cannot differentiate between resources that are free and those openly licensed under the Creative Commons system or other models. This difference is vital because during the utilization of free, but not open resources, the legal permissions required to perform the 5R activities of OER engagement cannot be done.

4.2 OER Competence and Skills

The second competence of OER literacy is centered on practical competencies and skills needed to be engaged in open educational resources. This involves the capacity to search, find, and use pertinent OER, analyze the quality and suitability of resources, customize and upturn content based on particular situations of instruction, generate original OER content, and use suitable open licensing to new work. The analyzed literature suggests that although pre-service teachers can gain awareness of OER rather rapidly, they need to go through more learning experiences, which are more systematic and long-term to attain the development of practical competence.

German research by Rahden *et al.* (2023)^[36] investigated the beliefs of 1,386 prospective teachers regarding professional digital competence and found seven dimensions, content creation and open resource adaptation being two dimensions where pre-service teachers indicated a lower level of confidence. Their evidence indicates that pre-service teachers believe more in their overall digital competence than in their particular ability to use open educational resources, which means that they have to be taught specific skills in the area of OER-related competency.

Creative Commons Certificate is a teacher-focused open education program, which was created by Creative Commons (2022)^[8] as a systematic way to build the competence of open education, including topics such as the open education landscape, open pedagogy, and practical skills to create and use OER. Research investigating the effects of such certificate programs on pre-service teachers has identified beneficial outcomes on competence and confidence, and the participants state that they are more competent to apply open licensing, make use of existing resources, and incorporate OER in lesson planning (Creative Commons, 2022)^[8].

One of the issues that are spotted in the literature is the training of evaluation skills that would be required to determine the quality and suitability of OER. In contrast to the textbooks used in the commercial world which usually go through a formal review process, the quality of OER differ greatly and the teachers have to learn critical evaluation skills to find out whether certain resources can address their needs and quality requirements. According to Rahimi and Mosalli (2024)^[37], critical thinking is one of the digital global competence elements because pre-service teachers should be given systematic ways to train to assess and choose OER to meet certain pedagogical needs.

4.3 OER Pedagogical Integration

The third aspect of OER literacy is the integration of open resources in pedagogical teaching and learning activities.

This aspect goes beyond technical competence using OER to also encompass the skill of designing instruction that takes advantage of the specific affordance of openness, how OER usage can be made in support of learning goals, and how effective learning experiences can be achieved that would otherwise be inaccessible using closed resources. The analyzed articles also indicate that the most problematic aspect of OER literacy pre-service teachers have to cultivate is pedagogical integration.

The idea of OER-enabled pedagogy as introduced by Wiley and Hilton (2018) ^[49] gives one the means of appreciating the disruptive nature of OER in case it is carefully incorporated into the teaching process. Their contribution is to point out that the value of OER goes beyond saving money to include pedagogical methods that can only be implemented or achieved when teachers are legally and technically free to revise, remix, and share teaching and learning materials. Yet, achieving this potential poses the challenge that pre-service teachers do not merely need to acquire technical skills but should also become pedagogically visionary and creative when it comes to creating open learning experiences.

A study conducted by Arispe, Hoyer, and Haynes (2025) ^[2] focused on the use of the 5Rs of OER by K-12 teachers, and established that although awareness of the 5R framework may be cultivated during the course of professional development, more protracted support and modeling were necessary to facilitate actual implementation of 5R of OER in instruction. They found that those teachers that attended a four month cohort of workshops that were synchronous and monthly meetings and asynchronous assignments had statistically significant results in terms of revising and remixing behaviors compared to minimal exposure of webinars and newsletters.

The literature review on pre-service teachers integrating OER in pedagogy has revealed a number of variables that promote or inhibit this aspect of OER literacy. Faculty modeling proved to be one of the key factors, and pre-service teachers admitted that they were more confident and ready to consider OER integration when they saw their teacher educators modeling open pedagogies (Karunanayaka *et al.*, 2015, 2018) ^[25, 24]. On the other hand, lack of OER integration in teacher education course work was related with less pedagogical competence with graduating pre-service teachers.

4.4 Factors Influencing the OER Literacy Development

The studies that have been reviewed revealed that the factors and reasons that impact the formation of OER literacy among pre-service teachers could be divided into individual, programmatic, and institutional levels. At an individual level, experience in technology beforehand, readiness to innovate, and individual ideas regarding teaching and learning were determined to have an effect on how pre-service teachers were to adopt OER. Dolezal *et al.* (2025) ^[10] discovered that gender and grade level differences in the digital literacy and technology use proficiency of pre-service teachers were significantly different, indicating that personal traits might be more likely to affect OER development trajectories.

The explicit inclusion of the concepts and skills of OER in the teacher education curriculums became a determinant at

the programmatic level. Comparative studies of teacher education programs including and not including OER-focused coursework revealed that there are significant differences in the OER literacy level of the graduating pre-service teachers. McGarr and McDonagh (2020) ^[30] noted that pre-service teachers were not only active users of technology, but also claimed less skills in the use of other digital technologies, including OER, which, argues the necessity to provide explicit curricular coverage of open educational practices.

Infrastructure, such as access to professional growth, OER repository availability, and policy frameworks that promote open educational activities were found to be a major accelerator of OER literacy development. The analyzed sources, however, indicate that institutional support of this kind in the situation of teacher education is usually not present. Tlili *et al.* (2022) ^[44] selected five categories of barriers to OER adoption in African settings such as policy gaps, infrastructure barriers, financial barriers, pedagogical barriers, and personal factors, most of which are applicable to the teacher education environment across the globe.

4.5 OER Effectiveness and OER Effectiveness Empirical Evidence and Adoption

The usefulness of Open Educational Resources (OER) has been a popular topic in empirical studies, specifically in terms of achievement, affordability, and cost savings. The initial signs of success were that open textbooks were found to increase student access to learning content (Feldstein *et al.*, 2012) ^[12], especially among learners who were economically disadvantaged. Their results indicated that OER improve not only the accessibility but also positively impact the course completion rates and academic engagement.

On the same note, a study carried out by Hilton and Laman (2012) ^[19] on the use of open psychology textbook revealed that students did not seem to be at a disadvantage compared to those who used the traditional commercial textbooks but the cost saved when using an open psychology textbook is significant. Hilton *et al.* (2013) ^[20] also supported this conclusion, as the authors observed OER use in a local mathematics department at a community college and did not find any differences in learning outcomes, but rather a positive effect on student satisfaction and access to materials.

Hilton (2016) ^[17] has managed to synthesize the results of a large number of studies and outline that the adoption of OER does not affect the effectiveness of learning, and it can, in fact, improve academic performance and retention in certain instances. The research has put forward that the main benefit of OER is that it offers fair access to quality education materials without creating financial difficulties to students.

In addition to its effectiveness, recent studies have also examined how OER can be used to solve equity and social justice problems. Hodgkinson-Williams and Trotter (2018) ^[21] suggested a social justice paradigm and argued that OER has the potential to democratize knowledge, especially in the Global South. Nevertheless, they also stated that access is not just enough; some meaningful participation needs some contextualization of content and integration of the local knowledge systems.

4.6 OER Adoption and Teacher Practices

The implementation of OER is directly associated with instructional culture and practice. Kimmons (2016) ^[26] coined the term of expansive openness and it is important to note that the use of OERs requires the readiness of the teacher to practice openness, i.e. sharing, adapting, collaborating. This view moves resources to the background and practices to the forefront, which is more in line with the larger idea of Open Educational Practices (OEP).

Continuing on this point, Wiley and Hilton (2018) ^[49] described OER-enabled pedagogy as teaching and learning activities that can just occur as the result of open licenses accompanying OER. These are practices involving student-created content, co-created knowledge building, and renewable tasks that help to broaden the knowledge ecosystem. Wiley *et al.* (2017) ^[48] empirically indicated that student-created OER may boost engagement, ownership of learning, as well as academic achievement.

In his qualitative research, Tang (2020) ^[41] discovered that instructors are aware of the opportunities offered by OER in enhancing flexibility and student engagement in the teaching process, but are confronted with time limitations, the absence of training, and institutional support. On the same note, Tang *et al.* (2020) ^[42] noted that the intention of teachers to use OER depends on the perceptions on usefulness, ease of use, and institutional support.

4.7 Student perceptions and Learning outcomes

Student learning experiences with OER have also been a popular research topic. Lin and Tang (2017) ^[29] concluded that the application of OER in statistics courses positively influenced a decrease in anxiety in students and enhanced the confidence in learning complicated topics. This implies that OER has the potential of supporting inclusive learning environments.

Read *et al.* (2020) ^[38] also studied the correlation between the use of OERs and student socioeconomic status and found that the adoption of OERs is especially beneficial to low-income students who do not need to face financial obstacles in their education. Their results support the use of OER to foster educational equity and inclusion.

Also, the development of digital technologies has increased the potential of OER. The authors conducted a study on AI-enhanced textbooks and discovered that textbook features of interactivity and adaptability can improve student engagement and conceptual learning (Koć-Januchta *et al.*, 2020) ^[27]. In the same manner, Genesereth *et al.* (2020) ^[15] suggested that in the future, the integration of OER and artificial intelligence into the learning process will take a path of development of intelligent OER systems that would customize learning processes to student needs.

4.8 OER, Future Directions, Technology

The OER has been given a global perspective regarding how it can help in educational inequalities in various situations. Tang and Bao (2020) ^[43] stressed the fact that OER can induce social justice, though the equality in digital access and literacy, which is the second-level digital divide, restricts its application in less privileged areas. Furthermore, the literature indicates that successful implementation of OER also needs capacity building and contextual adaptation that is in addition to access. Teachers need to have the capacity to alter and customize OER to various cultural and educational backgrounds. This is especially essential in the developing nations where the standard content might not be relevant to local demand.

Table 1: Distribution of Studies by Region

Region	Number of Studies (n=42)	Percentage (%)
North America	14	31.11
Europe	12	26.67
Asia	10	22.22
Africa	4	8.89
Multi-national	5	11.11

Table 2: Distribution of Studies by Research Design

Research Design	Number of Studies	Percentage (%)
Quantitative Surveys	19	42.22
Qualitative Case Studies	13	28.89
Mixed Methods	10	22.22
Experimental/Quasi-experimental	3	6.67

Table 3: Dimensions of OER Literacy

Dimension	Description	Key Components
Awareness	Understanding of OER concepts and resources	Knowledge of OER, repositories, licensing
Competence	Practical skills to use OER	Searching, evaluating, adapting, creating OER
Pedagogical Integration	Use of OER in teaching-learning	Lesson design, open pedagogy, 5R framework

Table 4: Barriers to OER Literacy

Barrier Category	Description	Supporting Studies
Lack of Awareness	Limited understanding of OER concepts	Appiah <i>et al.</i> (2020) ^[1] , Tlili <i>et al.</i> (2022) ^[44]
Time Constraints	Difficulty in finding/adapting OER	Bond <i>et al.</i> (2024) ^[6]
Licensing Confusion	Poor knowledge of copyright/CC licenses	Gurav and Nagarkar, (2025) ^[16] ; Bond <i>et al.</i> , (2021) ^[5]
Lack of Training	Insufficient professional development	Karunanayaka <i>et al.</i> (2015) ^[25]
Institutional Barriers	Weak policy and infrastructure support	Tlili <i>et al.</i> (2022) ^[44]

Table 5: Facilitators of OER Literacy

Facilitator	Description	Evidence
Faculty Modeling	Teachers demonstrate OER use	Karunanayaka <i>et al.</i> (2015) ^[25]
Professional Development	Training programs and workshops	Arispe <i>et al.</i> (2025) ^[2]
Curriculum Integration	Inclusion of OER in syllabus	McGarr & McDonagh (2020) ^[30]
Institutional Support	Policies and infrastructure	Pawlyshyn <i>et al.</i> (2013) ^[34]

5. Discussion

This scoping review has mapped the present research situation on OER literacy in pre-service teachers in three dimensions that are interrelated: awareness, competence, and pedagogical integration. The results indicate a discipline that is expanding in size and complexity but is also marked by the presence of vast discrepancies between how OER has the potential to revolutionize the education of teachers and the state of pre-service teacher training in the present. Different important themes are identified in this synthesis that have significant implications on research, policy, and practice.

First, the review is able to establish that OER literacy is a construct that is multidimensional and goes far beyond mere awareness of open educational resources. Pre-service teachers can be aware of the term OER and have a general idea that these resources are free and can be found, but the pre-service teachers do not know or use the skills to find, access, modify, and efficiently use open resources in their professional instruction. This result is consistent with the general research on integrating technology with education, which notes that the successful application of technology in instructional practice entails more than technical proficiency, but also pedagogical expertise and situational awareness (Mishra and Koehler, 2006; Joo *et al.*, 2018) ^[31, 22].

Second, the review demonstrates the paramount significance of explicit, systematic learning opportunities that can be used to gain OER literacy. The research always obtained the same conclusion: pre-service teachers who were provided with explicit guidance on the OER concepts, Creative Commons licensing, and open pedagogical practices showed much better levels of OER literacy than did those who did not receive such guidance. This observation brings significant implications to the design of teacher education curriculum implying that OER literacy needs to be purposefully entrenched in teacher preparation programs instead of incidentally produced in general technology education programs.

Third, the idea of OER-facilitated pedagogy (Wiley and Hilton, 2018) ^[48] is one of the possible benefits of this review that should be seen as an especially potentially fruitful approach toward going beyond the level of basic OER competence to the level of transformative pedagogical integration. According to the reviewed studies, pre-service teachers that know not just how to utilize OER, but also how to take advantage of the authorizations of being open in order to design learning experiences that would not be possible in the conditions of closed resources are more likely to achieve the full potential of open education. Nevertheless, this level of pedagogical sophistication cannot be achieved without modeling, practice, and long-term support which is probably not always present in most teacher education settings.

The results of this review should be taken into account with regards to a number of limitations. The literature search was confined to studies that were published in English and this may have omitted the possibility of having research on the subject of other non-English speaking settings. Besides, due to the dynamism of OER and open educational practices, new developments might have occurred since this review was done. The study designs, measures, and contexts that

comprise this scoping review are too heterogeneous to achieve the meta-analysis of effect sizes, and the limitations of the given scoping review do not allow making certain conclusions regarding the efficacy of certain OER literacy interventions.

6. Conclusion

This scoping review has reviewed the scope and quality of research on OER literacy in pre-service teachers, demonstrating some major achievements as well as current gaps in the process of equipping future teachers with the competencies needed to work with open educational and teaching tools effectively. The results indicate that OER literacy includes three dimensions that are interconnected and interrelated such as awareness, competence, and pedagogical integration that demand different but complementary types of learning and support. Although the general attitude of pre-service teachers towards OER is generally positive, there are still tremendous gaps in their knowledge of open licensing, their practical abilities to work with open materials, and their ability to use the affordances of openness to transformative pedagogy.

Based on the review, there are a number of priorities highlighted on the way forward in terms of OER literacy in teacher education. The first is that teacher education programs ought to incorporate the concepts of OER and skills in its curriculum and offer systematic experiences that pre-service teachers can acquire awareness, competence, and pedagogical integration skills. Second, modeling open educational practices by the faculty is crucial as pre-service teachers have more frequent chances to embrace OER in case their instructors practice the open resources and pedagogies. Third, the long-term professional growth and guidance is required to go beyond awareness to practice competence and pedagogical innovation.

To the researchers, this review demonstrates that there is a need to conduct more rigorous studies that are theoretically based to investigate how OER literacy is developed among pre-service teachers. The longitudinal designs that shall be used in future research should be able to trace OER literacy progression through teacher preparation, the correlation between OER literacy and future teaching practice and the most suitable strategies to be used in each of the three dimensions of OER literacy development. Also, studies are required to learn how OER literacy may interact with other types of teacher knowledge and how this phenomenon may be evaluated in the most effective way.

With the education community worldwide still adopting open educational resources as a tool of delivering equitable access to quality education, the issue of teacher education is becoming more essential in equipping educational institutions with OER-literate instructors. The implications of the findings of this review are that to achieve the potential transformative nature of OER, it will be necessary to make a deliberate and prolonged investment in building the knowledge, skills and dispositions through which pre-service teachers can be transformed into productive users of open education.

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8. Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this research paper.

9. Future Suggestions / Future Scope

Based on the findings of this scoping review, the following future suggestions are proposed:

1. OER literacy should be integrated into Curriculum Teacher education programs by injecting OER literacy as a systematic element into the curriculum so as to make the pre-service teachers create a systematic awareness, competence and pedagogical integration.
2. Emphasis on Practical Training Future programs ought to focus on practical training in searching, assessing, adapting and creating OER, versus teaching theoretical content.
3. Professional Development Programs Ongoing professional development programs, workshops and certification courses (e.g. Creative Commons training) should be implemented to improve the competencies of teachers in utilizing OERs and open pedagogy.
4. Research on Pedagogical Impact More longitudinal and empirical studies should be conducted to determine the effects of OER literacy on the effectiveness in teaching, student learning outcomes, and the long-term professional practices.
5. Questions to be asked in Future studies To ensure the quality measurement and pedagogical integration, future research must be directed at creating standardized tools and frameworks to measure OER literacy.
6. Enhancement of Institutional Support Educational institutions must establish policies, infrastructure, and inducement systems that will encourage the use and sustainable utilization of OER in teacher education.
7. Emphasis on Licensing To promote ethical and legal usage of OER, special attention should be paid to making people better acquainted with the copyright issues and the Creative Commons licensing.
8. Context-Specific Research (India and Developing Countries) More region-specific studies are required especially in the Indian setting to learn more about the issues of digital divide, limitations of infrastructure and policy gaps of adoption of OER.

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