

A Brazilian Perspective on Quality and Sustainability Aspects of Open Educational Resources in Computing Education

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Abstract. *Universities are increasingly adopting new technologies to enhance teaching, with Open Educational Resources (OER) playing a central role in expanding access to high-quality learning materials. However, although many OER are produced, these resources are underutilized, become outdated, or lack design elements that ensure long-term sustainability. This work identifies essential characteristics that support the effective and lasting integration of OER into educational practice. We conducted a survey and semi-structured interviews with Computing instructors who develop or use OER. The findings highlight key attributes that support OER reuse, maintenance, and longevity, underscoring the need for further research to inform sustainable OER design and development.*

1. Introduction

Developing and disseminating knowledge is essential for shaping competent citizens and professionals in both K–12 and higher education contexts [Masetto 2015]. In this scenario, instructors play a central role not only in mediating access to information but also in structuring instructional experiences that support student development. The increasing integration of Information and Communication Technologies (ICT) further reshapes educators' roles, encouraging the adoption of instructional strategies that go beyond traditional educational practices [Masetto 2015]. As a result, universities and instructors are urged to explore new technologies to expand teaching possibilities and to enhance their instructional approaches [Zabalza 2009]. Consequently, instructors are increasingly responsible for planning, creating, adapting, and maintaining teaching materials, whether textual or multimodal, in order to support effective instructional practices.

Within this evolving educational landscape, Open Educational Resources (OER) have become a key component of contemporary teaching ecosystems. The concept of OER was introduced in 2002 during the first Global Forum on Open Educational Resources [Hylén 2021]. OER are defined as openly licensed educational materials that allow free use, adaptation, and redistribution [Dutra and Tarouco 2007]. Their scope includes courses, learning objects, games, modules, and other instructional artifacts, as well as tools that support content creation, reuse, organization, and localization [Hylén 2021]. The availability and reuse of OER depend on appropriate copyright and intellectual property management, typically enabled through open licenses such as

the Open Content License, the GNU Free Documentation License, and Creative Commons [Dutra and Tarouco 2007]. These licensing models foster ethical dissemination and encourage collaborative and sustainable teaching practices.

OER are commonly stored in digital repositories, which serve as organized environments for sharing and exchanging educational resources, supporting collaborative authoring and reuse. Such repositories allow authors to select licensing options and facilitate the dissemination of teaching materials [Tarouco et al. 2014]. Despite the growing number of available OER, only a small portion are effectively adopted in teaching practice, and when they are used, they often remain in use for a limited period. This observation suggests that the primary challenge lies not in the creation or adaptation of OER, but in ensuring their long-term sustainability, that is, their continued relevance and use in instructional contexts over time. Although sustainability has gained attention as a research topic in the OER domain, the literature still lacks a comprehensive understanding of how sustainability is supported in both research and teaching practice.

Despite the availability of numerous OER, many resources remain underutilized in classrooms, even though their use can significantly support both instructional practice and student learning [Lupepso et al. 2016]. In this context, this work is motivated by the need to better understand the key characteristics and quality attributes that contribute to the acceptance, adoption, and sustained use of OER by instructors in the Computing field [de Oliveira et al. 2021, Kocak 2013]. Beyond identifying commonly used resources, this study seeks to examine the features that contribute to OER sustainability, making them usable and relevant over extended periods [Kern et al. 2018, Becker et al. 2015, Pressman and Maxim 2021]. By identifying these characteristics, we aim to provide insights that can inform the design, development, and selection of OER, supporting more effective and enduring teaching practices in Computing Education [Penzenstadler et al. 2012].

This paper is structured as follows: Section 2 shows the main related works. Section 3 presents the research method, including the research goal and questions, the survey's structure and execution, data analysis, and results. Section 4 outlines the planning, execution, and results of interviews conducted with instructors. Section 5 discusses the results obtained from conducting the survey and interview. Section 6 presents the threats to validity. Finally, Section 7 concludes this work and details some future work.

2. Related Work

The investigation of Open Educational Resources (OER) has been a recurring topic in educational research since UNESCO formally defined the term in 2002. Lupepso et al. (2026) conducted a study to examine the possibilities and challenges surrounding OER adoption, highlighting persistent difficulties that reveal the need for greater awareness, technical proficiency, and institutional support. Their analysis identified core OER-related concepts and organized them into 18 categories, including access to knowledge, resource adaptability, self-learning, sharing, digital technological spaces, social inclusion, open licensing, and cost reduction. Among the most recurring elements were "open space, resource adaptability," and "digital technological space." These categories were subsequently grouped into three broader dimensions: *knowledge*, *instrumental/operational*, and *use*, with the instrumental/operational dimension encompassing the most elements. This classification offers a comprehensive understanding of the multifaceted nature of OER and the diverse factors that influence their adoption and utilization.

Coelho et al. [Coelho et al. 2014] investigated the characterization and use of OER in higher education institutions in Portugal and Mozambique, aiming to identify adoption challenges and propose collaborative models that could foster broader institutional and pedagogical engagement. The study pursued three main objectives: (i) to deepen the understanding of OER use in higher education, (ii) to characterize collaborative practices related to OER adoption, and (iii) to propose a model for promoting OER at both institutional and educational levels. The authors emphasize that expanding the use of OER requires more than technical solutions, arguing that transforming educational practices into open practices demands cultural, organizational, and pedagogical changes aligned with global open education movements.

Similarly, Rossini and Santos [Rossini and Santos 2012] developed a continuing education program for teachers at the State University of Rio de Janeiro (EDU-UERJ), integrating Web 2.0 tools with the creation, adaptation, and sharing of OER in both institutional and global repositories. The initiative aimed to enhance collaborative and participatory teaching practices through the use of networked digital technologies. Within the context of cyberculture, the authors argue that OER play a central role in collaborative knowledge construction, the appreciation of diversity, and the continuous reinterpretation of educational materials. Their project, which combined research, production, and dissemination of OER, aimed to foster educators' capacity to author and reuse high-quality open digital resources.

Mtebe and Raisamo [Mtebe and Raisamo 2014] employed the Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate Tanzanian teachers' intentions to adopt OER and to identify barriers to their use in higher education. Their findings indicate that performance expectancy, facilitating conditions, and social influence do not significantly affect adoption intentions. In contrast, effort expectancy—teachers' perception that OER are easy to use—positively influences their intention to adopt these resources. The authors also identified major barriers, including limited internet connectivity, concerns regarding the quality of available OER, and insufficient awareness of copyright and licensing issues. These factors significantly hinder effective adoption and sustained use. Table 1 summarizes the main related initiatives addressing quality attributes and adoption challenges of OER.

Tabela 1. Summary of Related Work on OER

Reference	Context	Objective/Focus
Lupepso et al. (2016)	General	To examine the possibilities and challenges surrounding OER adoption.
Coelho et al. (2014)	Higher education institutions in Portugal and Mozambique	To investigate OER characterization and use; identify adoption challenges; and outline collaborative models.
Rossini and Santos (2012)	State University of Rio de Janeiro (EDU-UERJ)	To develop a continuing education program for teachers integrating Web 2.0 tools with OER creation, reappropriation, and sharing.
Mtebe and Raisamo (2014)	Higher education in Tanzania	To employ UTAUT to examine teachers' intentions to adopt OER and identify barriers.

Based on the analyzed studies, it is evident that there is a recurring emphasis on fostering an institutional culture of openness that supports reflective pedagogical practices and active engagement. Nevertheless, persistent challenges—such as infrastructural limitations, uneven resource quality, and gaps in copyright literacy—indicate a significant

research gap regarding the essential characteristics of high-quality OER and the mechanisms that sustain them in the long term. This gap is particularly relevant in the Brazilian educational context, which is characterized by significant regional diversity and persistent structural inequalities. In such a scenario, scaling OER adoption requires systematic approaches that go beyond awareness initiatives, reinforcing the importance of investigating quality and sustainability attributes that support the enduring use of instructional materials.

3. First Study: Survey

This section outlines the first phase of our research, focusing on surveying with computing instructors. The goal is to investigate the primary characteristics and quality attributes of OER that contribute to their sustained use over an extended period. The planning for this survey encompasses various aspects, including goal, survey design and execution, and data analysis.

3.1. Research Questions

To guide this initial investigation, the following research questions (RQs) were defined:

- RQ₁: What types of OER are currently used by computing instructors in classroom settings?
- RQ₂: Which quality attributes of OER are considered essential for their instructional use?
- RQ₃: What characteristics are crucial for ensuring the long-term usability of OER?

3.2. Survey Design and Execution

To address the research questions, we designed and conducted an online survey using Google Forms, a widely adopted platform that facilitates data collection and management. The survey instrument was structured to capture computing instructors' perceptions regarding the use, quality, and sustainability of Open Educational Resources (OER) in instructional contexts, with an emphasis on teaching practices rather than learning outcomes.

The target population consisted of computing instructors who actively use OER in their teaching. Participants were invited through mailing lists associated with major Brazilian computing and education events, including the Brazilian Congress of Informatics in Education (CBIE), the Workshop on Education in Computing (WEI), the Brazilian Symposium on Software Quality (SBQS), the Brazilian Symposium on Information Systems (SBSI), and the Brazilian Symposium on Software Engineering (SBES). Additionally, invitations were sent directly to experienced instructors and researchers in the field.

The survey was conducted in Brazil, acknowledging that educational practices, institutional conditions, and technological infrastructures are strongly influenced by contextual factors. By focusing on the Brazilian context, this study aims to provide insights relevant to computing education within this national setting, while acknowledging that the findings may not be directly generalizable to other educational contexts.

Based on the research objectives, the questionnaire was organized into five components. The **first component** collected demographic information, including gender, age, geographic region, education level, institution type and name, and years of teaching experience. The **second** focused on the instructional use of OER and included questions about

frequently used resource types, disciplines in which OER are applied, duration of use, selection criteria, and perceived quality attributes. This component combined predefined lists with open-ended questions, allowing participants to report additional resources and instructional contexts. The **third component** addressed sustainability aspects and asked participants to evaluate characteristics related to the long-term viability and maintenance of OER. The **fourth component** consisted of qualitative questions designed to understand the perceived importance of selected quality and sustainability attributes. Finally, the **fifth component** included open-ended questions that enabled participants to suggest additional attributes, identify challenges related to OER adoption, and describe essential criteria for defining and selecting high-quality OER for instructional use.

Participation in the survey was voluntary, and all participants were informed about the study objectives through a consent form. No personal identifying information was collected, and participants could withdraw from the study at any time. The questionnaire, written in Portuguese, consisted of 21 questions divided into seven sections, with an estimated completion time of approximately 20 minutes. The final version of the questionnaire is available at [Omitted due to review].

To ensure the clarity and quality of the questionnaire, a pilot study was conducted with two computing instructors. They evaluated the instrument on clarity, logical order, adequacy of answer options, and ease of navigation. Based on their feedback, minor revisions were made, including rewriting some answer options, removing redundant items, revising the form description, and correcting spelling errors, resulting in a clearer, more consistent instrument.

The online survey was available for 2 months. During this time, invitations and reminders were sent three times through selected mailing lists and professional networks to encourage participation. The response rate was monitored throughout the data collection period.

3.3. Data Analysis

The survey data were analyzed using descriptive statistics and visualizations, such as bar charts and pie charts, to support the interpretation of instructors' responses regarding the use, quality, and sustainability of OER.

3.4. Results

This section presents the results of the survey conducted with computing instructors in Brazil. We first describe the participants' profiles to provide context for the findings. Subsequently, we report and discuss the results in accordance with the defined RQs (RQ₁-RQ₃).

3.4.1. Participants' Profile

We received 25 valid responses from instructors residing in different Brazilian states, providing a geographically diverse sample.

Regarding gender, most respondents identified as cisgender men (76%), while cisgender women accounted for 24%. This distribution reflects the well-documented gender imbalance in the computing field. In terms of age, participants were predominantly aged 31-50. The largest group comprised instructors aged 41 to 50 (40%), followed by those

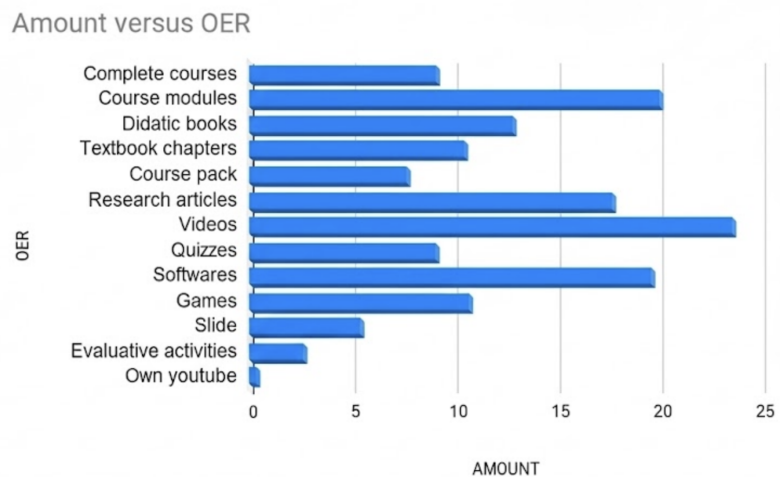


Figura 1. The most used OER in the Computing area

aged 31 to 40 (36%). Smaller proportions were observed among respondents aged 51 to 60 (16%), 21 to 30 (4%), and 81 to 89 (4%).

Concerning geographic distribution, São Paulo (20%) and Minas Gerais (24%) presented the highest participation rates, followed by Goiás (12%). Other states, such as Mato Grosso do Sul, Pernambuco, and Paraíba, accounted for 8% of responses, while Rio Grande do Sul, Paraná, Ceará, Piauí, and Amazonas each accounted for 4%.

Most respondents reported high levels of academic qualifications. While 4% held only an undergraduate degree, 12% had completed a master's degree, and the majority (80%) held a Ph.D., indicating strong academic engagement with the topic.

Regarding institutional context, 92% of respondents reported experience teaching in public institutions, whereas 16% indicated experience in private institutions. Teaching experience varied considerably. Approximately 32% of participants had more than 15 years of experience, while 28% reported 10-15 years. Smaller proportions were observed among instructors with less than 10 years of teaching experience.

3.4.2. RQ₁: What are the main OER currently utilized in classrooms?

Participants were presented with a curated list of well-known OER and asked to indicate those used in their teaching practices. As shown in Figure 1, videos were the most frequently reported resource (88%), followed by research articles (72%), software tools (68%), slideshows (60%), and textbooks (56%). Respondents also reported additional OER types, such as images, audio materials, animations, podcasts, and simulators, highlighting the diversity of resources used in computing education.

The survey also investigated the disciplines in which OER are most commonly applied. Figure 2 presents a word cloud summarizing the courses reported by participants, providing an overview of the breadth of computing-related contexts in which OER are employed.

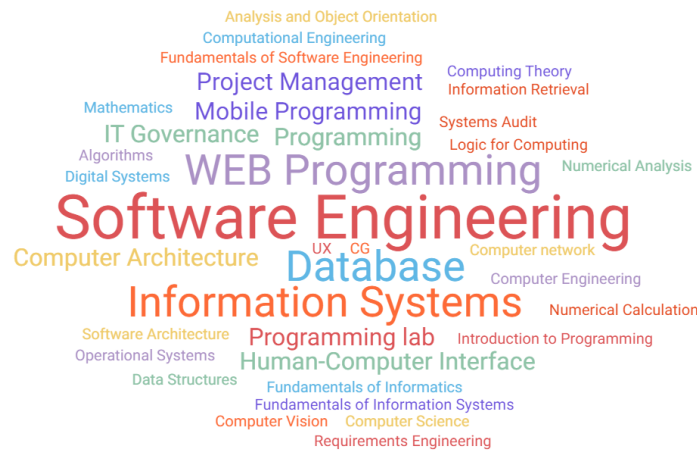


Figura 2. Subjects in which OER are used by respondents

3.4.3. RQ₂: Which quality attributes of OER are deemed essential for practical use by instructors?

Participants evaluated a comprehensive set of OER quality attributes by rating their importance on a Likert scale. Figure 3 summarizes the attributes considered most relevant for the practical use of OER.

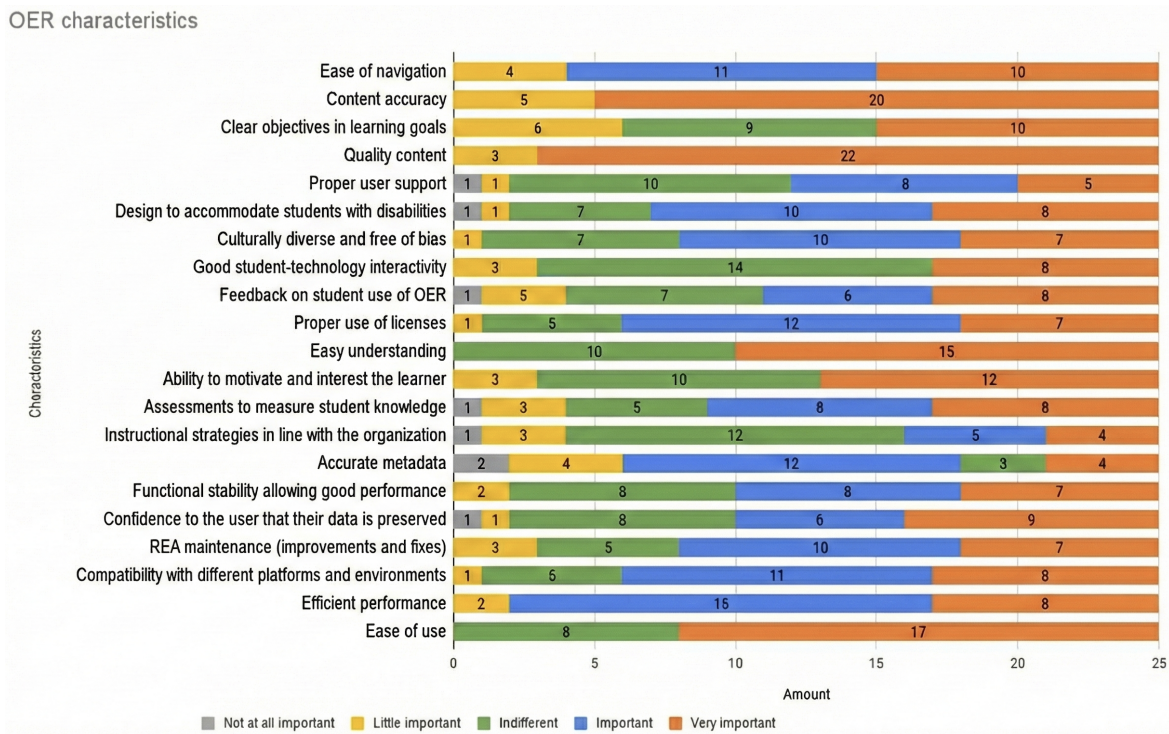


Figura 3. OER Characteristics and how important they are

The results indicate that content accuracy and content quality were perceived as the most critical attributes, receiving the highest concentration of ratings in the very important category. This finding suggests that instructors prioritize reliable and well-

structured educational materials when selecting OER for classroom use. Ease of use also emerged as a highly valued attribute, reflecting instructors' concern with accessibility and the seamless integration of digital resources into teaching activities.

In contrast, the accuracy of metadata received lower importance ratings, with many respondents classifying it as not important or of low importance. This result suggests that metadata precision plays a secondary role in instructors' decision-making, compared to content-related and usability aspects.

3.4.4. RQ₃: What characteristics are crucial for an OER to maintain usability over the years?

Respondents emphasized usability as the most important characteristic for the sustained use of OER, as shown in Figure 4. This result reinforces that clear navigation and user-friendly interfaces are central expectations when educators integrate OER into teaching.

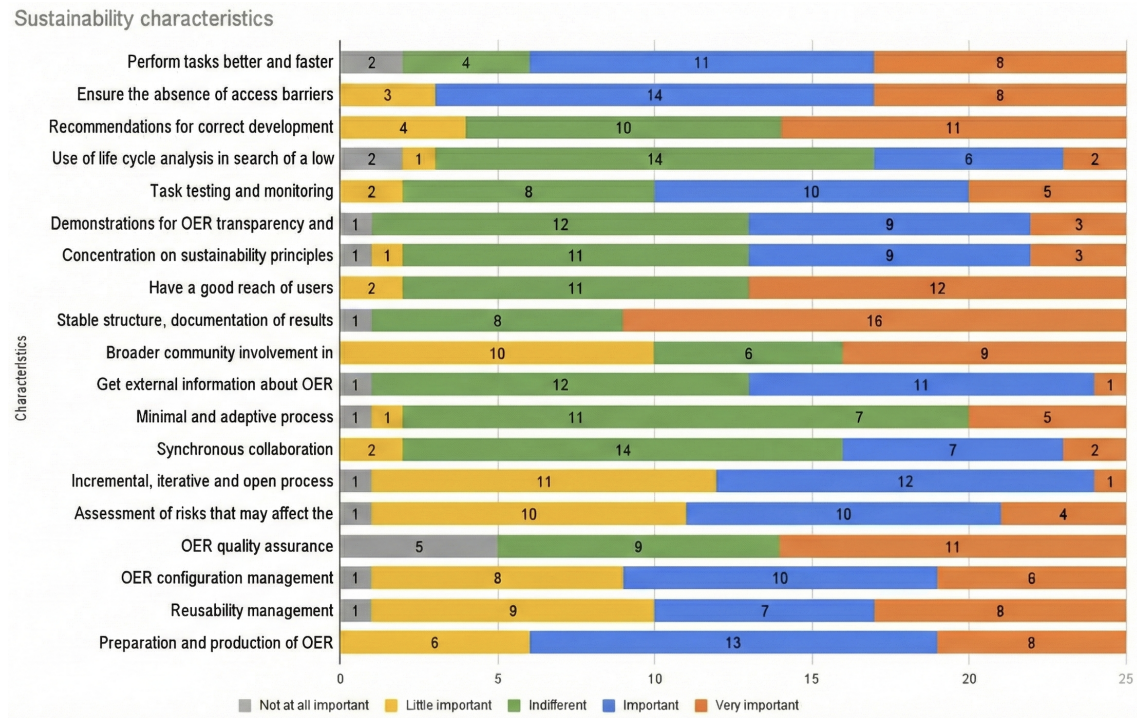


Figure 4. Attributes that help in the sustainability of OER

Beyond usability, participants highlighted attributes related to structural reliability and pedagogical clarity. A stable structure was valued for supporting coherent learning paths, while documentation of results was considered important for clarifying expected outcomes and educational contributions.

Interaction-related aspects were also mentioned, particularly ease of discussion, which was associated with fostering collaborative learning environments. Broad user reach was another relevant attribute, reflecting the expectation that OER be adaptable to diverse audiences and educational contexts. Participants further stressed the importance of development recommendations, indicating the need for methodological guidance and

best practices to ensure content quality. In addition, guaranteeing the absence of access barriers was reaffirmed as essential for equitable dissemination and effective use of OER.

In contrast, several characteristics were assigned lower priority. Environmental concerns, such as life-cycle analysis to achieve low environmental impact, were rarely mentioned. Similarly, attributes related to efficient task performance and testing and monitoring tasks received limited attention, suggesting that operational efficiency and formal assessment mechanisms are not central to instructors' evaluations.

Likewise, broader sustainability principles and values, as well as aspects related to minimal and adaptive processes, were infrequently reported. This suggests these dimensions currently have a limited influence on educators' decisions regarding OER adoption.

Overall, these results clarify educators' priorities by distinguishing attributes essential for long-term OER use and those with limited impact on adoption decisions. This perspective can inform developers, institutions, and policymakers seeking to align OER initiatives with the needs of the computing education community in Brazil.

4. Second Study: Interviews with Teachers

In the next phase, we conducted interviews with six teachers who actively integrate OER into their teaching. This qualitative stage aimed to validate the evidence gathered from the literature and the earlier survey while deepening our understanding of instructors' perceptions. The interviews were designed to move beyond surface-level observations by exploring participants' experiences, priorities, and criteria for evaluating the quality of OER. This study enabled a more comprehensive and contextualized analysis, refining our understanding of how OER are used and sustained in educational settings.

4.1. Planning of Interviews

The planning stage began with the development of a structured interview script and the recruitment of participants through targeted email invitations. The purpose of the interviews was to validate and contextualize the evidence gathered throughout the study. The protocol first collected demographic data, such as institutional affiliation, institution type, and teaching experience. Subsequent questions examined the instructors' use of OER, identifying the resources employed, the courses in which they were integrated, and the duration of use. The interviews also explored criteria for OER quality, factors influencing adoption, and characteristics necessary for long-term sustainability. Additionally, participants described the challenges in adopting OER and suggested possible strategies to address them, providing a comprehensive understanding of OER adoption dynamics.

4.2. Execution

To initiate the interview phase, we sent invitation emails to 19 teachers nationwide, outlining the study's objectives and thematic scope. Teacher responses were received within one to two weeks. Once participants confirmed their interest, interview times were scheduled based on their availability. Within three weeks of outreach, six interviews were conducted, each lasting approximately 30 minutes. These focused conversations enabled participants to share perspectives and experiences in depth, generating meaningful qualitative evidence for the study.

4.3. Results

The interviewees included both men and women, all of whom are instructors in computing education working at public institutions. Their teaching experience ranged from 8 to 32 years. When describing their teaching practices, participants reported frequently using resources closely related to computing, such as websites, YouTube channels, software tools, games, slides, virtual learning environments, collections, online courses, and code editors. The prevalence of these resources highlights their central role in contemporary computing education.

A notable finding concerns the long-standing use of OER by several participants, often predating their formal awareness of the term. Many instructors reported having used open resources intuitively, without initially identifying them as OER. As expressed by E3: *“I used an OER in 2019 without knowing it was an OER. I only became aware of the concept in 2020 during my specialization in computing applied to education.”* This illustrates the organic adoption of OER in teaching practices.

Interviewees consistently emphasized quality-related attributes as essential for OER use. E1 highlighted the importance of reliable sources, stating that trustworthy content and sound structure are fundamental. Similarly, E2 highlighted usability issues from the student perspective, noting frequent complaints about the interface and interaction design of tools such as JFLAP in formal languages courses.

Content quality was repeatedly mentioned as a decisive factor. E3 emphasized correctness and clarity, stressing that well-written materials based on reliable sources are crucial for adoption. From a practical standpoint, E6 underscored the need for a low learning curve, arguing that OER should support teaching rather than require excessive time to learn, reinforcing the importance of good interfaces and user experience.

Regarding sustainability, interviewees emphasized the importance of maintenance and regular updates as key attributes. E2 emphasized the need for ongoing maintenance to ensure long-term usability, while E4 noted that resources maintained by large companies tend to remain up to date. These perspectives reveal a shared concern with the continuity and relevance of OER over time. Additional sustainability aspects were also identified. E5 stressed the importance of conceptual accuracy as a stable and non-negotiable element of quality. Motivation emerged as another relevant factor, with E1 emphasizing its role in sustaining engagement. E2 mentioned technological adaptability, noting the need for resources compatible with current devices, such as smartphones, to remain aligned with contemporary educational practices.

E4 described acceptability testing as an important strategy for improving OER, involving instructor feedback and iterative refinement. Community engagement was also highlighted by E6, who emphasized that active user communities contribute to sustained interest, sharing of experiences, and long-term viability of resources. Together, these aspects highlight the importance of accuracy, motivation, adaptability, and collaboration in ensuring the sustainability of OER.

Interviewees also reported several challenges related to OER adoption. A recurring issue was teacher motivation to explore alternative teaching approaches, as noted by E2. E1 emphasized the difficulty of selecting appropriate materials given diverse learning profiles and the abundance of available resources.

Limited awareness and discoverability of OER were identified as additional bar-

riers to adoption. E3 highlighted difficulties in identifying OER, locating suitable repositories, and assessing the frequency of resource updates. Structural constraints were also mentioned by E4, including insufficient infrastructure, limited internet access, and a lack of teacher preparation in public schools.

Finally, participants highlighted the challenge of keeping educational content up to date. E5 noted the dynamic nature of teaching materials, while E6 highlighted resistance to continuous education and innovation in teaching practices. These challenges underscore the need to address motivational, cultural, and infrastructural factors to support effective and sustained OER adoption.

5. Discussion

The significance of OER in education is undeniable. They offer freely accessible, adapted resources, fostering widespread dissemination of knowledge. In computing, OER plays a crucial role in updating and distributing relevant content. An inherent advantage in computing education is that OER promotes active learning, enabling students to engage with resources, manipulate code, experiment, and explore complex concepts. This leads to more meaningful learning experiences and the development of essential practical skills.

Moreover, OER offers flexibility, allowing for adaptation to various pedagogical approaches and student needs. They accommodate different learning styles and levels, and can be updated swiftly, ensuring content remains current. However, for OER to be effective and sustainable, quality characteristics must be prioritized during development.

Successful OER implementation requires rigorous evaluation by computing education experts to ensure content accuracy and pedagogical coherence. Establishing clear guidelines and quality criteria is essential, as it provides developers with the tools to create high-quality resources. OER contributes to democratizing knowledge and enhancing the learning experience, offering free access and promoting practical computing education.

Emphasizing the sustainability of OER ensures universal access, reduces costs, fosters innovation, and encourages lifelong learning. Incorporating quality attributes is critical to ensuring effectiveness, trust, accessibility, usability, and long-term sustainability, maximizing their impact on computing education.

6. Threats to Validity

As with any empirical study, this research is subject to threats to the validity of its findings. To systematically analyze these limitations, we adopt the classification proposed by Wohlin et al. [Wohlin et al. 2012], which organizes validity threats into conclusion, internal, construct, and external dimensions. Below, we discuss the main threats identified in this study and the measures taken to mitigate them.

Conclusion Validity Threats concern factors that may compromise the reliability of the conclusions drawn from the data. The primary threat in this study is the relatively small sample size, common in exploratory studies in Computing Education and Informatics in Education. A limited number of participants may reduce statistical power and weaken inferences, making the results indicative rather than definitive. Additionally, response bias may be present, as participants could provide socially desirable answers, particularly given the increasing attention to sustainability and quality aspects of OER. To mitigate these threats, results are interpreted cautiously, and the study is positioned as exploratory, with replication planned in future work involving larger and more diverse samples.

Internal Validity Threats relate to potential biases in the study design and execution. Selection bias is a significant risk, as participation was voluntary and respondents were recruited through academic mailing lists and professional networks, which may favor instructors already interested in OER. Moreover, misunderstandings arising from ambiguously phrased questions could undermine response consistency. These threats were mitigated through a pilot study, careful revision of the questionnaire, and the use of clear, objective, and neutral wording in all survey items.

Construct Validity Threats concern the extent to which the instruments accurately capture the intended concepts. In this study, construct validity may be influenced by the interpretation of abstract concepts such as OER quality and sustainability, which may vary among participants. To mitigate this risk, the survey used attributes grounded in prior literature and combined closed- and open-ended questions, enabling participants to clarify their interpretations and offer complementary perspectives.

External Validity Threats address the generalizability of the results beyond the studied context. The findings are influenced by the Brazilian educational context, including institutional conditions, technological infrastructure, and cultural aspects of teaching in Computing. Furthermore, changes in educational practices or technologies after data collection may affect the relevance of the results over time. While these factors limit direct generalization to other contexts, focusing on a specific national setting provides a realistic and context-sensitive understanding of OER use in practice.

7. Conclusions and Future Work

OER have the potential to transform computing education by providing accessible, adaptable, and high-quality instructional materials. However, our findings indicate that, despite their availability, many OER remain underutilized, unknown, or challenging to integrate into teaching and learning environments. This study identified key quality attributes, including content accuracy, usability, pedagogical clarity, and structural reliability, that are crucial for the practical adoption and long-term sustainability of OER in computing education. By highlighting these characteristics, our work contributes to a nuanced understanding of what makes OER effective and enduring in real educational contexts.

The research also points to several opportunities to enhance OER adoption and impact. Centralized repositories that aggregate high-quality OER, combined with awareness campaigns and professional development initiatives, can significantly improve discoverability and integration. Moreover, fostering active collaboration between students and teachers in the creation and adaptation of OER can strengthen engagement, promote ownership, and ensure that resources remain relevant over time.

As part of our ongoing efforts, we are initiating the development of a structured process for producing sustainable OER in computing education. This initiative focuses on co-creation, iterative improvement, and alignment with both pedagogical and technological requirements. By systematically addressing quality, usability, and sustainability from the design phase, we aim to produce OER that are not only immediately useful but also capable of enduring across evolving educational contexts. Ultimately, this study underscores the importance of combining rigorous quality standards with strategic dissemination and active community engagement to maximize the potential of OER. We hope that these insights will inform future initiatives in computing education and support the development of open resources with lasting impact.

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AI Use Disclosure

In accordance with ACM guidelines, we disclose that Artificial Intelligence (AI) tools were used only for non-substantive editorial assistance. ChatGPT was employed for language refinement, Gemini Colab for generating illustrative figures, and Grammarly for minor proofreading. All methodological decisions, data analysis, and interpretations were performed independently by the authors. No AI tool contributed to the scientific content, claims, or conclusions of this paper.

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