Accessibility in interactive systems: what do software developers think, do, and aim for?

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Abstract

Digital accessibility, while recognized as a quality criterion within Software Engineering and Human-Computer Interaction, is also a legal requirement in several countries, including Brazil. Despite these regulatory advances, accessibility barriers remain prevalent across many systems, warranting further academic discussion and the development of mitigation strategies. Research in this field commonly adopts an end-user perspective; however, it is also necessary to investigate the factors contributing to the lack of accessibility. This includes examining the educational process in Computing and, specifically, developers' perspectives on digital accessibility, professional practices, and the challenges they face in the industry. To provide a comprehensive understanding of this landscape, this study presents a systematic mapping study across seven scientific databases, focusing on studies that address digital accessibility from a developer's perspective. The results reveal that research from the developer's perspective is most prevalent among researchers in Brazil and the United States. The 24 analyzed studies in full point to issues related to a lack of knowledge of technical and human factors, as well as organizational and cost constraints. Overall, the literature highlights the complexity of the topic and the need for integrated efforts among researchers and practitioners in Software Engineering, Human-Computer Interaction, and Computing Education to effectively incorporate accessibility into both academic training and development practices, while accounting for the implementation costs of these requirements.

Keywords

Digital Accessibility, Developers' perspective, Accessibility in industry

1 Introduction

Digital Accessibility is a fundamental requirement of computational systems, as accessible solutions enable individuals to use them regardless of their physical or cognitive conditions [15, 26]. For this reason, the fields of Human-Computer Interaction (HCI) and Software Engineering consider accessibility as a quality attribute of computational solutions [8, 25], dedicating specific attention to the development of approaches that contribute to meeting this characteristic [9, 42].

Extending beyond the scope of computing best practices, the Brazilian Inclusion Law (LBI - Law No. 13.146/2015) mandates the provision of accessibility features on websites, encompassing both portals and web systems [1]. To support its implementation, the Modelo de Acessibilidade em Governo Eletrônico (eMAG), developed by the Federal Government, was conceived as a reference for public institutions to meet accessibility requirements [11]. At the international level, guidelines exist to help make web content more accessible. Notable among these are the Web Content Accessibility Guidelines (WCAG), developed by the World Wide Web Consortium (W3C) [46].

Despite these initiatives, developing accessible software systems is a demanding, time-consuming endeavor fraught with several challenges [16]. Studies highlight, for instance, negative views among developers toward the topic, often stemming from the effort required to implement accessibility features [33, 35]. Such criticisms relate to the complex and impractical nature of accessibility guidelines, as well as their length, which involves globally recognized standards like the WCAG [33, 35].

However, from an industry perspective, the inclusion of accessibility requirements in interactive systems does not depend solely on individual developer initiative. Cultural, organizational, and technical factors, such as a lack of institutional support, the absence of appropriate tools, resources, and methods, and constraints on time, budget, and senior management support, shape the inclusion of accessibility requirements in interactive systems [6, 10, 33]. Furthermore, in the technical sphere, academic training for developers often addresses accessibility issues peripherally, resulting in insufficient preparation for implementing these requirements [14]. Then, digital accessibility is not yet a recurring practice in software development [31]. Given this scenario, it is essential to investigate the reasons contributing to this reality, particularly considering the perspective of developers, who play a central role in this process [30].

Consequently, this work aims to map, from the perspective of software developers, the practices, perceptions, and challenges involved in implementing accessibility requirements in interactive systems. By focusing on the developer's perspective, this work aims to identify real situations faced by these professionals and highlight nuances that the user perspective cannot capture. In this sense, the results of this work enable a macro-level visualization of the main factors influencing the adoption of accessible practices in software development from the developer's perspective.

This panoramic view of the findings creates opportunities for new investigations in both HCI and Software Engineering. In particular, from a Software Engineering perspective, identifying developer challenges, practices, and perspectives allows for directing efforts toward investigating new approaches and methods in the development process. These can assist by focusing on the identified bottlenecks in implementing accessibility requirements and in improving or creating tools that integrate accessibility into the workflow. Moreover, within the field of Software Engineering, identifying best practices in the analyzed studies can contribute to future research on the development of technical guidelines by identifying solutions better aligned with development teams. Thus, the synthesis consolidates evidence on training, tools, organizational culture, and development practices that may inform the future design and evaluation of such guidelines.

For the field of HCI, the contribution is generated derivatively through the contributions to Software Engineering. That is, the search for new solutions that meet the real needs of software developers for implementing accessibility requirements would help make software systems more accessible. Consequently, the end-user experience, especially for those who require accessibility features, would improve.

The remainder of this work is organized as follows. Section 2 presents the related work. Section 3 describes the research method, including the definition of the research questions, the search strategy, the selection criteria, and the data extraction procedures. Section 4 reports and discusses the main findings, structured around the research questions and focusing on developers' knowledge, perceptions, and practices. Section 5 outlines the key challenges and opportunities identified based on the results. Section 6 discusses threats to the validity of the work. Finally, Section 7 concludes the paper and presents directions for future work.

2 Related Work

In the field of Digital Accessibility, Systematic Mapping Studies predominantly emphasize end-user perspectives, focusing on usability, User Experience (UX), and accessibility-related outcomes. For instance, Rosa and Valentim [37] conducted a systematic mapping to identify design technologies for Accessibility, Usability, and UX in the development of Information and Communication Technologies (ICTs) for visually impaired individuals. The study identified 23 technologies, mostly targeting mobile applications, and concluded that few approaches integrated accessibility, usability, and UX concurrently. Similarly, de Godoi et al. [18] mapped technologies that developers can employ to evaluate usability, UX, and accessibility factors to enhance the quality of Assistive Technologies.

The mapping performed by Silveira et al. [40] sought to identify software accessibility attributes and measurements for visually impaired users in the technical literature. The authors identified 14 attributes and 24 measurements; however, most of them refer to Web resources, which may limit their applicability to other platforms. In contrast, Campoverde-Molina and Luján-Mora [12] mapped the use of artificial intelligence in Web accessibility based on 53 studies from major scientific databases. The authors identified applications such as AI-based APIs, plugins, image and voice recognition, automated accessibility correction, and the generation of accessible HTML code via prompts.

Regarding the effectiveness of current methods, Mateus et al. [32] conducted a meta-analysis of 38 types of accessibility problems in websites and mobile applications across 38 studies. The results demonstrated that automated evaluation tools have significant limitations, identifying 40% fewer issues on websites and 20% fewer in mobile applications than manual methods. As an exception, [38] aligns more closely with the scope of this mapping by identifying practices related to continuous integration and automated accessibility testing. This research identifies adoption barriers, tool integration into CI/CD pipelines, automation benefits, agile practices, and developer training.

These findings suggest that the theme addressed in this article remains relevant, particularly in addressing existing gaps in understanding developers' perspectives, challenges, and practices in developing accessible solutions.

Table 1: Temporal coverage of the analyzed studies

Study	Year	Goals	Timeframe
[40]	2018	Attributes and measures of software accessibility for visually impaired people	2002–2009
[37]	2020	Design technologies of Accessibility, Usability, and UX	2003–2019
[18]	2021	Technologies to assess usability, UX, and accessibility	1997–2018
[32]	2021	Accessibility problems on websites and mobile applications	2014–2020
[38]	2021	Continuous Integration and Automated Accessibility Testing	None
[12]	2026	AI-based approaches to improve digital accessibility	2018–2025
This paper	2026	Developers' perspectives, challenges and approaches to implement accessibility	2008–2026

Table 1 summarizes the temporal coverage of the cited systematic mappings. While some studies lack pre-established temporal boundaries, the data allow for delimiting the collection range of the analyzed studies. Notably, most studies concentrate on earlier periods and do not incorporate recent developments in digital accessibility.

Moreover, although previous studies make relevant contributions to the field of Digital Accessibility, most emphasize their investigations from the perspectives of end-users, evaluation methods, or automated assessment techniques. Conversely, this mapping focuses on the software developer's perspective, investigating their perceptions, challenges, and practices during the implementation of accessibility requirements. This approach fills a significant gap in the Digital Accessibility literature, as the implementation of accessible systems depends heavily on the decisions, knowledge, and organizational environment of development teams. Additionally, this study contributes to integrating the fields of Accessibility and Software Engineering by recognizing that the lack of accessible systems may also be associated with Software Engineering-related challenges, including development practices, tools, and workflows.

3 Materials and Methods

To conduct the SMS and answer our three research questions (RQs), we formulated them as follows:

- **RQ1**. Do software developers possess the necessary technical knowledge to implement accessibility requirements in interactive systems?
- **RQ2**. What are the developers' perceptions of the technical, organizational, and cultural aspects that influence the implementation of accessible systems?
- **RQ3**. Which approaches, methodologies, or tools do developers use to support the development process of accessible solutions?

Defining RQs plays a fundamental role in Systematic Mapping Study (SMS), as the entire process is guided by these inquiries [28]. In this regard, **RQ1** seeks to determine whether developers have the necessary skills and knowledge to implement accessibility requirements, including familiarity with WCAG guidelines. As noted in the literature, computing education in Brazil does not include mandatory Human-Computer Interaction or digital accessibility content in undergraduate courses, as highlighted by [7] in their list of challenges to teaching HCI in Brazil. When analyzing strictly from a formal educational perspective, professionals may lack knowledge of accessibility guidelines or best practices. However, given the field's dynamic nature, developers commonly update their technical skills continuously. Thus, providing a diagnosis of developers' technical knowledge regarding accessibility implementation is a factor that contributes positively to understanding the current landscape and its limitations.

RQ2 aims to understand developers' perceptions of how social and institutional aspects (deadlines, accessibility prioritization, internal policies, etc.) shape adherence to accessibility requirements. Beyond technical and knowledge-based challenges, cultural and organizational factors can affect the implementation of accessibility features [36]. It is important to identify these factors, for instance, the prioritization of new-feature delivery, and to understand that developers' perceptions of accessibility are often of low priority. Simultaneously, it is crucial to understand developers' views when an organization adopts accessibility features as a quality criterion.

RQ3 seeks to catalog methodologies, languages, libraries, frameworks, plugins, and extensions that assist in fulfilling accessibility requirements. Various resources and tools exist to support the implementation of accessibility features. Understanding these technical resources and the methodologies that support accessible development, and cataloging them, is important for disseminating best practices and discussing the effectiveness of each.

3.1 Conducting the SMS

3.1.1 Search Databases. The studies selected for analysis were retrieved from established scientific databases: ACM Digital Library, IEEE Xplore, SpringerLink, ScienceDirect, SOL (SBC OpenLib), Scopus, and Engineering Village. These sources were selected to combine broad multidisciplinary indexes with libraries covering Software Engineering, HCI, and Brazilian computing research.

3.1.2 Search Strings. We constructed the search string using the PICOC method [28], prioritizing Population, Intervention, and Outcome (PIO), because Comparison and Context were not central to this mapping. Population comprised terms for developers and related roles (*developer*, *programmer*, *software engineer*, *professional*, and *practitioner*); Intervention was digital accessibility; and Outcome comprised challenges, barriers, difficulties, problems, practices, perceptions, perspectives, experiences, and awareness. Candidate synonyms were collected from recurrent terminology in known relevant control studies and adapted to each database's syntax.

In all databases, the automated search was restricted to the title field. This decision was made after preliminary broader searches returned a large number of records outside the scope of this study. Therefore, the title-field restriction was adopted as a precision-oriented strategy to maintain a feasible screening process and align it with the research questions. However, this choice may have reduced recall by excluding relevant studies that mention developer-related accessibility issues only in abstracts or keywords; this limitation is discussed in Section 6.

The strings in Table 2 initially returned 594 records. ScienceDirect limits the terms and operators accepted by its advanced search, so its broader query returned 322 records. We applied a Python script[1] that tested title, abstract, and keywords against the concatenated protocol terms, retaining 21 records. Manual inspection of the same result set identified two additional records whose wording was not captured by the automated filter. Both underwent the same inclusion/exclusion and quality procedures as all other candidates; neither was included solely by the researcher's judgment. This produced 23 ScienceDirect candidates and 295 candidates across all databases.

3.1.3 Inclusion and Exclusion Criteria. Following Kitchenham et al. [28], inclusion and exclusion criteria were defined based on the RQs to find primary studies providing direct evidence. The inclusion criteria were:

- **IC1**: Studies reporting challenges, perceptions, or practices regarding accessibility implementation from the software developer's perspective.
- **IC2**: Studies involving professional experience rather than educational simulations.
- **IC3**: Studies published in English or Portuguese.
- **IC4**: Primary studies.

The exclusion criteria were:

- **EC1**: Studies that do not meet the inclusion criteria.
- **EC2**: Studies not addressing the developer's perspective, focusing exclusively on end-users.

[1] https://doi.org/10.5281/zenodo.21421265

Table 2: Search strings used in the respective databases. All searches were conducted on November 21, 2025.

Database	Search String	Quantity
ACM Digital Library	(develop* OR program* OR "software engineer*" OR professional* OR practitioner*) AND (accessib*) AND (challeng* OR barrier* OR difficult* OR problem* OR practice* OR percept* OR perspective* OR experience* OR awareness)	37
IEEE Xplore	("Document Title":develop* OR "Document Title":program* OR "Document Title":"software engineer*" OR "Document Title":professional* OR "Document Title":practitioner*) AND ("Document Title":accessib*) AND ("Document Title":challeng* OR "Document Title":barrier* OR "Document Title":difficult* OR "Document Title":problem* OR "Document Title":practice* OR "Document Title":percept* OR "Document Title":perspective* OR "Document Title":experience* OR "Document Title":awareness)	15
SpringerLink	(develop* OR program* OR "software engineer*" OR professional* OR practitioner*) AND (accessib*) AND (challeng* OR barrier* OR difficult* OR problem* OR practice* OR percept* OR perspective* OR experience* OR awareness)	31
ScienceDirect	(accessibility) AND (challenge OR barrier OR difficult OR practice OR percept OR perspective OR awareness)	322
SOL (SBC OpenLib)	(develop* OR program* OR "software engineer*" OR professional* OR practitioner*) AND (accessib*) AND (challeng* OR barrier* OR difficult* OR problem* OR practice* OR percept* OR perspective* OR experience* OR awareness)	11
Scopus	TITLE((developer OR programmer OR "software engineer" OR professional* OR practitioner*) AND (accessib*) AND (challeng* OR barrier* OR difficult* OR problem* OR practice* OR percept* OR perspective* OR experience* OR awareness))	73
Engineering Village	(develop* OR program* OR "software engineer*" OR professional* OR practitioner*) AND (accessib*) AND (challeng* OR barrier* OR difficult* OR problem* OR practice* OR percept* OR perspective* OR experience* OR awareness)	105

- **EC3**: Studies regarding accessibility for the developer (e.g., developers with disabilities).
- **EC4**: Non-scientific publications.
- **EC5**: Duplicates from other databases.
- **EC6**: Studies not involving surveys, interviews, or developer reports (e.g., forums or social media).

The inclusion and exclusion criteria were defined to map digital accessibility from the developers' perspective. For this reason, we prioritized studies based on surveys, interviews, questionnaires, experience reports, or other forms of direct developer reporting, since these methods provide explicit evidence about developers' knowledge, perceptions, practices, and challenges. As a consequence, EC6 excluded studies based solely on observational data, case studies, tool evaluations, or accessibility assessments without direct evidence from developers. This decision helped maintain alignment with the research questions, but it also narrowed the scope of the mapping and may have excluded relevant evidence about accessibility practices in real development contexts.

After removing duplicates, 203 studies were analyzed. We conducted this stage in pairs by two researchers to reduce bias, with a third researcher acting as a tie-breaker.

Table 3: Decisions of the two researchers regarding the 203 studies

	B: Approved	B: Rejected
A: Approved	28	2
A: Rejected	27	146

Of the 203 studies, 28 were approved by both and 146 rejected by both. Disagreements occurred in 29 cases. We calculated Cohen's Kappa index [13] to be 57.8%, classified as "moderate" agreement. It is worth noting that a third researcher adjudicated all divergent cases and re-examined records previously excluded by the first two researchers to reduce undue exclusions. Eight disputed studies were accepted, producing 36 studies for quality assessment. Adjudication resolved final decisions but does not eliminate the residual risk created by the initial moderate agreement, as discussed in Section 6.

3.1.4 Quality Criteria. To ensure complete reporting, we applied the quality criteria, assigning a maximum score of 4. A minimum score of 50% (2 points) was required for inclusion. The criteria were:

- **QC1**: The study states the number of participating developers.
- **QC2**: The study provides demographic data (e.g., experience level, field) of the participants.
- **QC3**: The study describes instruments or approaches used for data collection.
- **QC4**: The study makes the analysis data publicly available.

These criteria assess whether each report provides sufficient information for data extraction and synthesis, including participant characterization, data-collection procedures, and availability of analysis data.

Of the 36 studies, we excluded 5 based on quality criteria and 7 due to the unavailability of the full text. Thus, 24 studies were selected for extraction.

3.1.5 Data Extraction. Data extraction was performed by reading the 24 selected primary studies in full. According to Kitchenham et al. [28], extraction sheets must contain all information necessary to answer the RQs, along with standard data such as title, authors, publication venue, and country.

For the narrative synthesis, relevant excerpts from the primary studies first received descriptive codes. These codes were then compared across studies and organized into the following main categories: Knowledge, Tools, Competence, Training, Effort, Inclusion, Organizational Aspects, and Evaluation. Three categories were further refined into subcategories: Knowledge comprised knowledge about human factors, knowledge about guidelines, and knowledge about legislation; Training comprised academic training and complementary training; and Inclusion comprised developer inclusion and company inclusion. The remaining categories were analyzed without subcategories. After this categorization, the main categories were mapped to the research questions based on their analytical focus, enabling the evidence to be synthesized in sections addressing developers' knowledge, challenges, practices, stakeholders, and opportunities. Zotero supported annotation and tagging, while Google Sheets stored extraction fields, study identifiers, and category assignments. The extraction form, coding material, database-level results, and inclusion/exclusion justifications are available in the repository[2].

Table 4: The 24 primary studies included in the SMS

Study title	Reference
A survey on accessibility awareness of Brazilian web developers	[5]
A survey on the accessibility awareness of people involved in web development projects in Brazil	[20]
A survey on the awareness of Brazilian web development community about cognitive accessibility	[36]
Perspectives and Practices of Digital Accessibility: A Survey of User Experience Professionals in Nordic Countries	[22]
Strategic Insights into Integrating Accessibility in Software Development: Motivations, Barriers, Commitments, and Business Value	[16]
Studying industry practices of accessibility requirements in agile development	[33]
Why Software is Not Accessible: Technology Professionals' Perspectives and Challenges	[35]
Accessibility challenges and tool features: an IBM Web developer perspective	[41]
Mobile Accessibility Guidelines Adoption under the Perspective of Developers and Designers	[17]
A Qualitative Investigation of Real World Accessible Design Experiences within a Large Scale Commercial Game Development Studio	[29]
Understanding VR Accessibility Practices of VR Professionals	[44]
Automating Accessibility Compliance: Leveraging Machine Learning to Analyze Developer Challenges with WCAG Guidelines	[2]
Managing Accessibility Requirements in Web Application Development Projects: The Perspectives from Research and the Industry	[34]
Exploring Accessibility Trends and Challenges in Mobile App Development: A Study of Stack Overflow Questions	[24]
How Web Professionals Perceive Web Accessibility in Practice: Active Roles, Process Phases and Key Disabilities	[43]
Web accessibility in Turkey: awareness, understanding and practices of user experience professionals	[23]
Understanding developer challenges and trends in web accessibility: a stack overflow analysis	[3]
Understanding mindsets, skills, current practices, and barriers of adoption of digital accessibility in Kuwait's software development landscape	[4]
Evaluating and monitoring digital accessibility: practitioners' perspectives on challenges and opportunities	[39]
Awareness, Understanding, and Attitudes of Digital Accessibility in Technology Professionals	[19]
Accessibility in the mobile development industry in Brazil: Awareness, knowledge, adoption, motivations and barriers	[31]
Accessibility in Software Practice: A Practitioner's Perspective	[10]
XR for All: Understanding Developers' Perspectives on Accessibility Integration in Extended Reality	[27][3]
Developer Perceptions on Utilising Low-Code Approaches to Build Accessible and Adaptive Applications for Seniors	[45][3]

4 Results and Discussion

This section presents the findings obtained from the SMS. Before addressing the research questions, we briefly characterize the corpus. Regarding geographic distribution, 10 of the 24 selected studies include at least one author affiliated with a Brazilian institution, and 10 include at least one author affiliated with an institution in the United States; as several studies stem from international collaborations, these groups overlap and are not restricted to authors from these countries. This concentration reflects the Brazilian community's sustained interest in digital accessibility beyond the end-user perspective. Temporally, apart from isolated publications in 2008 and 2010, no studies were retrieved between 2010 and 2017; the theme resurged from 2018 onward, likely following the growing prominence of digital accessibility, and recent studies indicate a shift from an exclusive focus on Web environments toward mobile applications and other interactive technologies.

4.1 RQ1: Do Software Developers Possess the Technical Knowledge Required to Implement Accessibility Requirements in Interactive Systems?

4.1.1 Formal Education and Complementary Training. The literature indicates that formal education and complementary training are among the most frequently evaluated factors among developers. Specifically, 15 of the 24 included studies (62.5%) address this issue [4, 5, 10, 16, 17, 20, 22, 23, 27, 31, 33–35, 39, 44]. These results suggest that a significant portion of the workforce lacks adequate training for implementing accessibility requirements. Within the Brazilian context, Freire et al. [20] highlights these limitations in training through a survey of 613 web developers, revealing that 56.38% received no accessibility training, while only 7.18% benefited from formal education in the field.

Several studies identify Digital Accessibility as a topic neglected by higher education computing curricula [4, 10, 16, 17, 20, 23, 27, 31, 35, 39, 44]. This absence often leaves professionals with significant knowledge gaps regarding the guidelines, standards, and practices essential to accessible development. Notably, four of the eleven studies highlighting these educational gaps focus on the Brazilian scenario, which may signal an urgent need for curricular reform [16, 17, 20, 31]. This phenomenon extends beyond Brazil, as emerging contexts such as Kuwait and Turkey, as well as developed regions like the United States and Nordic countries, report similar deficiencies [4, 22, 23, 35]. Furthermore,

[2]https://doi.org/10.5281/zenodo.21421265
[3]Preprint indexed by the Engineering Village database.

many studies emphasize the lack of specific organizational training [4, 5, 10, 17, 20, 22, 23, 27, 31, 33, 34, 44].

Consequently, developers frequently rely on self-directed and informal learning to bridge these gaps [4, 20, 27, 39]. However, this approach may lead to fragmented knowledge, hindering developers from adopting robust, consolidated practices. [39] underscores this reality by documenting the prevalence of on-the-job learning, noting that professionals find the time required to master digital accessibility concepts through self-training prohibitively high.

4.1.2 Assistive Technologies. Nine of the 24 analyzed studies (37.5%) examine developer knowledge concerning assistive technologies [3, 4, 20, 22, 23, 31, 33, 34, 41]. In general, results suggest that developers often do not understand how these technologies function. Even when they recognize certain tools, they often lack the technical expertise or confidence to apply them effectively to create accessible solutions. [31] emphasizes the critical distinction between recognizing assistive technologies and possessing the ability to implement features that ensure their correct operation. Conversely, [22] found that the majority of surveyed developers claimed familiarity with such technologies, suggesting that awareness levels may vary significantly across different regions or professional backgrounds.

4.1.3 Knowledge of Human Factors. The studies also evaluated knowledge levels regarding various types of disabilities [4, 20, 22, 23, 31, 35, 36]. The findings present a balanced view: four studies report that developers possess theoretical knowledge of human factors [20, 22, 23, 31], while three conclude the opposite [4, 35, 36]. Nevertheless, even where theoretical knowledge exists, it rarely translates into practice, as few developers demonstrate the experience necessary to build truly accessible systems [20, 22, 23, 31]. Additionally, research indicates a disproportionate focus on visual impairments; most developers neglect other conditions, such as motor, cognitive, and auditory disabilities, when implementing accessibility requirements [3, 5, 22–24, 33, 35, 36, 43].

4.1.4 Knowledge of Accessibility Guidelines. A majority of the studies (16 of 24, or 66.66%) assess the level of knowledge concerning accessibility guidelines [4, 5, 10, 17, 20, 22, 23, 27, 31, 33–36, 41, 43, 44]. Most of these studies reveal poor familiarity with global standards such as the WCAG. However, some exceptions exist; for instance, web developers at IBM demonstrate strong adherence to guidelines like WCAG and Section 508, driven by a corporate culture that mandates technological compliance through internal checklists [41]. Other studies also found scenarios where developers reported awareness of primary guidelines [10, 27, 43].

4.2 RQ2: What are the developers' perceptions regarding the technical, organizational, and cultural aspects that influence the implementation of accessible systems?

4.2.1 Effort and Complexity of Implementation. Several studies indicate that developers perceive the implementation of accessible features as a highly complex activity requiring significant effort [2–5, 10, 16, 20, 22–24, 27, 29, 31, 33, 35, 39, 41, 44, 45]. Developers highlight that meeting these requirements demands specialized knowledge and substantial time, particularly when reconciling Accessibility best practices across diverse technological stacks.

4.2.2 Lack of Organizational Support and Consideration. The analysis reveals that developers often feel a lack of organizational support, a theme addressed in 17 of the 24 articles (70.83%) [4, 5, 10, 17, 20, 22, 23, 27, 29, 31, 33–36, 39, 43, 44]. Evidence suggests that leadership and management often neglect the adoption of accessible practices. Consequently, firms fail to allocate adequate budgets, human resources, or clear goals toward Accessibility, hindering its integration into the development lifecycle. [16] identifies managerial indifference as a primary obstacle, noting that individual developer efforts cannot overcome the lack of institutional policies. Similarly, [31] links this lack of support to market pressures and tight deadlines, which force leadership to prioritize functional features over Accessibility. Additionally, the absence of client demand, particularly in Agile contexts, and a shortage of accessibility specialists further discourage adoption [4, 5, 10, 17, 20, 22, 23, 33, 39].

4.2.3 Ethics, Empathy, and Social Responsibility. Ten studies show that ethical considerations, empathy, and social responsibility significantly influence developers' decisions to incorporate accessibility [4, 16, 17, 20, 22, 23, 31, 33, 36, 45]. For these professionals, the decision to implement accessible requirements transcends technical or organizational mandates, stemming instead from personal values related to inclusion and digital democratization.

4.2.4 Stigma and Misperceptions of the Target Audience. In contrast, nine studies identify a false perception among developers that people with disabilities do not belong to their application's target audience [4, 5, 20, 22, 23, 27, 31, 36, 44]. This misconception leads developers to view Accessibility as a peripheral or low-impact concern, under the mistaken belief that such features benefit only a negligible number of users.

4.2.5 Complexity of Accessibility Guidelines. Developers also frequently criticize accessibility guidelines for being overly extensive, complex, and difficult to interpret [4, 10, 27, 33–36, 39]. As a result, even when developers consult these standards, they often apply them in a limited or incomplete manner.

4.2.6 Role Ambiguity and Conflict of Responsibility. Several studies report role ambiguity and a lack of clear accountability regarding accessibility [4, 10, 23, 27, 29, 45]. Without explicit task definitions, responsibility often becomes diffused across the team. For example, [29] observes that development teams in commercial game studios tend to shift accessibility responsibilities exclusively to the User Interface (UI) team, leading to priority conflicts. Although some studies report greater consensus on roles, the overall trend indicates a lack of definitive ownership [5, 22].

4.2.7 Legal Compliance. Compliance with existing legislation remains a powerful driver of the adoption of accessibility requirements [5, 16, 20, 22, 27, 29, 31, 33, 34, 36, 39, 44, 45]. In these cases, developers implement accessible features primarily to fulfill legal obligations and avoid potential litigation. These findings emerge from studies across various regions, including Brazil, the Nordic countries, North America, the United Kingdom, and Portugal, as well as global surveys covering multiple continents [27, 39, 45].

4.3 RQ3: Which approaches, methodologies, or tools do developers use to support the development of accessible solutions?

4.3.1 Automated Testing Tools. Eight studies specifically name the automated testing tools used by professionals [3, 4, 10, 22, 24, 31, 33, 39]. In web development, practitioners favor browser extensions and scanning tools like WAVE and AChecker, alongside validation libraries such as Axe [4, 22, 33]. [3] further notes that developers use Microsoft's Accessibility Insights and the *axe-core* library (often integrated with Selenium) to validate guidelines directly in code. Other mentioned tools include ANDI for Agile testing and Hera for CSS validation [10, 33]. In the mobile sphere, developers rely on Espresso and Appium for both Android and iOS, and use native tools like the Xcode Accessibility Inspector and frameworks such as XCTest and KIF [24, 31]. Despite the variety of available tools, adoption remains low; [19] found that only 15% of developers use automated browser extensions.

4.3.2 Assistive Technologies as Testing Tools. Nine studies explore the use of assistive technologies as testing instruments [4, 5, 10, 16, 19, 22, 23, 31, 41]. While teams report testing with VoiceOver, TalkBack, or NVDA, these tools have not been adopted uniformly during testing.

4.3.3 Artificial Intelligence and Machine Learning. Recent research highlights the emergence of Artificial Intelligence (AI) and Machine Learning (ML) in supporting accessibility [10, 39]. During early development, developers use ML and mouse-tracking techniques to elicit requirements and identify where users abandon interactions, revealing previously unmapped barriers [10]. Furthermore, AI assists in converting complex documents into accessible formats and generating automatic descriptions for visual content. LLM-based tools (such as HintDroid, AXNav, and ChatGPT) help generate contextual alt-text for mobile apps, automate accessibility simulations, and inject corrections directly into HTML code [39].

4.3.4 Hybrid Accessibility Evaluation. Three studies advocate for a hybrid approach that combines automated tools with human expert supervision [10, 16, 39]. This strategy addresses the perceived unreliability of fully automated tools, which practitioners often find insufficient for guaranteeing comprehensive system accessibility.

4.3.5 Definition of Done (DoD). Three studies identify the integration of Accessibility into the "Definition of Done" (DoD) [10, 16, 33]. This approach treats Accessibility as a critical readiness criterion, ensuring that a software increment is considered complete only after its accessibility requirements are validated.

4.3.6 Accessibility as a First-Class Requirement. Treating Accessibility as a first-class requirement – incorporating it from the earliest phases of design and architecture – is considered essential for success [4, 10, 16, 27, 29, 44]. These studies emphasize that late-stage integration significantly increases complexity, as adapting established navigation flows and interactions is often difficult and costly.

4.3.7 Modularization and Code Reuse. The use of modularization and code reuse, as discussed by [10, 27], allows developers to implement decoupled, reusable accessibility components. This approach ensures more efficient implementation across different system sections or projects, thereby reducing the total production effort.

4.3.8 Predominant Adoption of WCAG. Despite the general lack of deep knowledge mentioned earlier, WCAG remains the primary reference for those who do consult accessibility standards, overshadowing other norms such as UAAG, ATAG, or ISO patterns [3, 10, 16, 19, 22, 34, 36, 39, 45].

4.3.9 Native Manufacturer Guidelines vs. WCAG. Finally, some developers, particularly in mobile and Virtual Reality (VR) environments, prioritize native platform guidelines over general standards [27, 31, 45]. Mobile developers frequently utilize Apple's UIKit to guide accessible design, while Extended Reality (XR) professionals often find traditional guidelines like WCAG ill-suited for 3D contexts. Consequently, they turn to platform-specific toolkits such as Microsoft's Mixed Reality Toolkit (MRTK), Unity's XR Interaction Toolkit, or OpenXR [27].

5 Challenges and Opportunities

5.1 Challenges

5.1.1 Gaps in formal and complementary education. As verified in Section 4.1.1, a large portion of developers lacks both adequate formal education and complementary training to develop accessible solutions [4, 5, 10, 16, 17, 20, 22, 23, 27, 31, 33–35, 39, 44]. In these studies, the gap left by incomplete education creates significant challenges in the development environment, including a lack of knowledge about efficient practices, tools, and methods. Consequently, this factor drives developers to neglect accessibility requirements entirely.

5.1.2 Lack of knowledge regarding assistive technologies and human factors. Sections 4.1.2 and 4.1.3 show that multiple studies identify developers' low familiarity with both assistive technologies and human factors [3, 4, 20, 22, 23, 31, 33–36, 41].

This lack of familiarity triggers substantial challenges when implementing accessibility requirements. For example, insufficient knowledge about assistive technologies leads developers to conduct incorrect application tests, as [41] explicitly details.

Furthermore, Section 4.1.3 identifies that the lack of knowledge about human factors, specifically regarding disabilities, also creates severe bottlenecks in development. As [39] notes, this knowledge gap is highly challenging; failing to understand users with disabilities' actual needs strips developers of the ability to empathize with their target audience, leading to misunderstandings and counterproductive outcomes. As a result, the solutions created to be accessible often fail to be effective or to meet the needs of those who require them comprehensively.

Additionally, an excessive focus on implementing accessibility requirements exclusively for visually impaired users constitutes another barrier in the development process [3, 5, 22–24, 33, 35, 36, 43]. The study by [36], which specifically addresses cognitive disabilities, highlights a widespread ignorance about disabilities other than visual impairments. This blind spot severely challenges developers when they attempt to create requirements that support diverse types of disabilities.

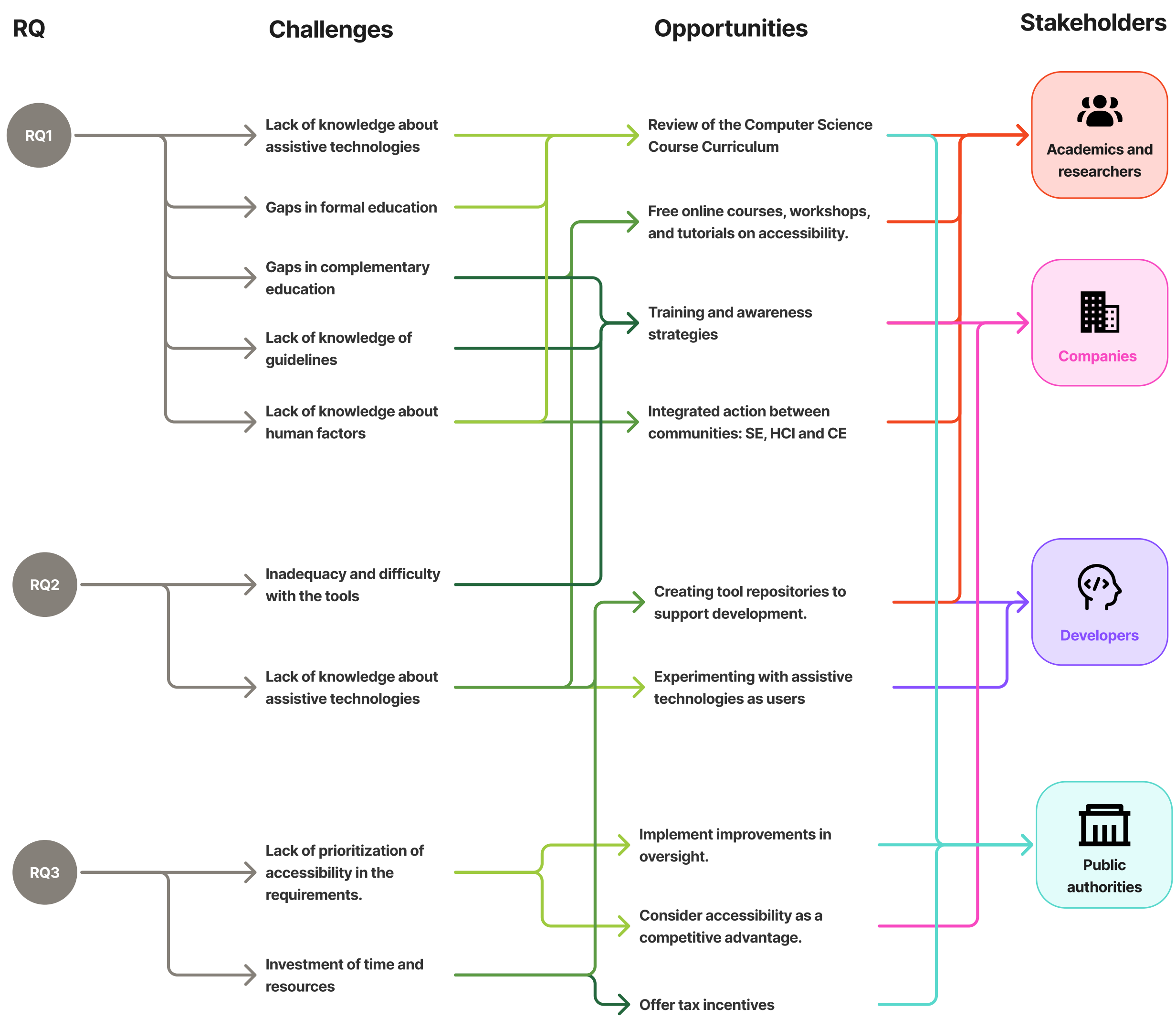

Figure 1: Overview of challenges and opportunities identified in the systematic mapping.

5.1.3 Lack of knowledge regarding accessibility guidelines and their complexities. Based on the gathered data, Section 4.1.4 highlights a large number of studies reporting developers' widespread ignorance regarding accessibility guidelines [4, 5, 17, 20, 22, 23, 27, 31, 33, 35, 36, 44]. Ignorance of these guidelines hinders and often completely prevents the implementation of accessibility requirements, routinely resulting in flawed accessibility practices.

5.1.4 Inadequacy and difficulties with tools. Ten of the 24 articles (41.67%) discuss the lack of tools that genuinely assist in developing accessibility requirements and highlight the technical difficulties these tools introduce during the development lifecycle [2, 3, 10, 24, 27, 35, 39, 41, 44, 45].

Professionals consistently report a lack of practical, user-friendly tools that can deliver quick solutions to accessibility problems. Moreover, developers heavily emphasize the lack of concrete examples demonstrating how to build accessible components from scratch.

Additionally, studies emphasize the severe limitations of automated testing tools [2, 10, 27, 39]. One of the main identified challenges involves the uncertainty regarding the accuracy of evaluations produced by these tools. Because these tools lack the reliability needed to guarantee system accessibility, developers face a heavy overload of manual testing. Therefore, manual testing remains the definitive means of verifying a software system's accessibility characteristics.

Finally, the authors note specific technical challenges related to existing tools. Notable examples include inconsistencies between screen readers and browsers, conflicts with third-party components and modern frameworks, incompatibilities with dynamically generated code, interferences and problems within native mobile components, and a stark lack of native integration in Extended Reality (XR) environments [2, 3, 10, 24, 27, 35, 39, 41, 44, 45].

5.1.5 Time and budget limitations. Regarding time and budget constraints, 17 of the 24 articles (70.83%) cite these limitations as direct contributing factors to the non-implementation of accessibility requirements [4, 5, 10, 16, 17, 20, 22, 23, 27, 29, 31, 33, 35, 39, 41, 44, 45].

The pressure of short deadlines and fast deliveries forces development teams to prioritize functional requirements. In many scenarios, teams treat accessibility requirements as optional or complementary features that require additional planning, leading developers to indefinitely postpone their implementation.

Furthermore, professionals frequently report budget constraints as one of the primary organizational hurdles. Adopting accessible practices requires financial investments in training, tooling, and usability testing with potential users. These factors increase the overall budget; thus, especially in smaller companies, management frequently pushes accessibility to the background.

5.2 Opportunities

The opportunities below are author-derived implications of recurring barriers in the 24 primary studies; they are not interventions whose effectiveness those studies evaluated. Each proposal is therefore linked to the mapped evidence that motivates it and requires validation in future empirical work.

5.2.1 Education. The recurring general ignorance regarding Digital Accessibility in the analyzed articles stands out as a core challenge that amplifies the low adoption rate of accessible features, as Section 4 evidences. Section 5.1.1 reveals that formal education remains deficient, while complementary training proves insufficient and often nonexistent concerning digital accessibility.

Regarding the formal education gap, there is a clear need to **revise the mandatory curricula of undergraduate computing programs**. Institutions must elevate digital accessibility by making related disciplines, such as Human-Computer Interaction, strictly mandatory for all computing students. This need has been discussed by different researchers from diverse communities. In Brazil, for example, the DCNs (National Curriculum Guidelines) for computing courses stipulate that students must understand the societal impacts of technology. However, these guidelines currently lack an explicit, enforceable mandate for digital accessibility as a foundational technical competency. Because of this regulatory ambiguity, universities frequently relegate universal design and accessible coding practices to elective modules rather than core requirements. To effectively close this educational gap, regulatory frameworks must be updated to establish accessibility standards as a direct accreditation criterion for programs, ensuring that all graduating developers are formally trained to build inclusive digital environments.

To address insufficient complementary training, institutions and companies can adopt several actionable approaches. They can provide **free online courses and workshops** on digital accessibility, and **corporate training** aimed at upskilling and reskilling current professionals. Companies can extend these training offerings to establish internal certification programs and foster dedicated accessibility communities. This strategy paves the way for efficient knowledge sharing, mitigating the daily technical challenges these professionals face.

Integrating digital accessibility into computing curricula and providing corporate training actively mitigates the other challenges identified in the literature. Specifically, these educational efforts directly address ignorance of human factors, a lack of familiarity with assistive technologies, and unawareness of key accessibility guidelines. Therefore, these improvement opportunities act synergistically to solve multiple problems simultaneously.

In light of the articles analyzed in this mapping, the lack of technical expertise strongly correlates with deeper structural problems, such as a fundamental lack of awareness regarding accessibility concepts. Thus, general awareness campaigns are highly relevant. They help professionals not only master the technical aspects of writing accessible code but also deeply understand the human importance of accessibility for the people who rely on it.

5.2.2 Organizational issues. Section 4.2.2 identifies the lack of managerial support as a prevalent perception and a severe challenge for developers. Negligence from managerial positions leads directly to resource reductions, budget cuts, and impossibly tight deadlines for developing accessibility requirements.

A viable strategy to capture managerial interest involves actively **shifting the corporate narrative from "legal compliance" to "competitive advantage"**. Advocates must quantitatively demonstrate that producing accessible systems positively impacts the company's profitability. Proposing solutions that ignore financial realities is unrealistic, given that a company's primary objective is to increase profits. Therefore, transforming the internal view of digital accessibility from a peripheral regulatory concern to a core business driver remains essential to reverse this scenario.

To achieve this, teams must leverage retention metrics to show that accessible products expand the user base, improve customer satisfaction rates, and build a stronger market brand, while also delivering clean interactions that benefit all users globally.

Another opportunity in this context involves creating tax incentives and improving enforcement mechanisms through public policy. These legal and financial mechanisms positively influence adoption by managerial roles, generating necessary pressure for compliance while simultaneously providing tangible economic incentives for companies.

5.2.3 Tools. Another identified challenge concerns the difficulty and inadequacy of tools for implementing accessible features, as discussed in Section 5.1.4.

Interestingly, the proposal to offer digital accessibility training within the corporate environment would also positively affect this specific scenario. Training sessions can systematically address tool inadequacy by heavily emphasizing the proper use and integration of these technical tools within modern workflows.

Furthermore, building and providing a centralized tool repository emerges as a highly relevant strategy to support developers. Such a repository would enable the broad reuse of established, accessible code solutions, thereby significantly reducing the manual effort required to implement accessibility features from scratch.

6 Threats to Validity

Although we applied strict methodological rigor throughout this Systematic Mapping, we identified specific threats to validity that readers must consider when interpreting the results.

The search strategy threatens completeness. All automated database searches were restricted to the title field because broader searches returned a large number of records outside the developer's scope. Although control studies were used to test the strings, relevant work that mentions accessibility or developers only in abstracts or keywords may have been missed. Database coverage and the English/Portuguese language restriction may also introduce bias in indexing and language.

Selection and extraction also require subjective judgment. Cohen's Kappa was 57.8%, indicating moderate agreement and some ambiguity in eligibility decisions. A third researcher adjudicated disagreements and rechecked excluded records, reducing but not eliminating the risk of erroneous exclusions. In addition, EC6 prioritized surveys, interviews, and developer reports because they provide direct evidence for the developer-perspective research questions; however, this decision excluded observational and case-study evidence.

Two of the included studies ([27, 45]) were preprints retrieved through the Engineering Village database. Although they had not undergone peer review at the time of this mapping, they met the established inclusion criteria and were retained to enrich the discussion. They represent a small proportion of the included evidence and were interpreted with appropriate caution.

The quality checklist primarily verifies the sufficiency of reporting for extraction. It does not replace a full risk-of-bias or methodological-rigor assessment; consequently, a study may meet the threshold while retaining design or validity limitations. Seven records without accessible full text could not be assessed using these criteria, introducing possible availability bias.

Brazil and the United States account for the largest shares of the selected corpus. As a complementary context, the DARE Index 2020 ranks both countries among the top ten performers worldwide, both in overall score and in digital accessibility implementation and outcomes [21], which may partly reflect stronger institutional and policy activity in these countries. Nevertheless, the language criteria, database coverage, and title-only search strategy may also have favored work from these countries. Therefore, country-level results characterize the retrieved corpus rather than global accessibility practice.

7 Final Remarks

This work addressed a critical gap in the literature by investigating digital accessibility from the perspective of software developers, using an SMS comprising 24 primary studies. Our findings reveal that the challenges associated with implementing accessibility requirements are not merely technical but inherently socio-technical, involving a complex interplay between individual knowledge, organizational priorities, and limitations of existing tools and processes.

The results indicate that the low adoption of accessibility practices cannot be attributed to a single factor. Instead, it arises from the convergence of multiple barriers, including insufficient formal education, lack of organizational support, limited familiarity with assistive technologies and guidelines, and time and budget constraints. These findings suggest that improving accessibility in software systems requires coordinated actions across different levels of the software development ecosystem.

From a **Software Engineering** perspective, this work reinforces that accessibility should not be treated as an optional or late-stage concern, but rather as a first-class quality attribute, integrated throughout the development lifecycle from requirements elicitation to testing and deployment. Our analysis shows that isolated efforts, such as training developers or adopting tools, are insufficient without organizational commitment and process-level integration.

Based on the evidence, we argue that advancing accessibility in practice demands a shift in how it is perceived and operationalized: from a compliance-driven activity to a strategic and systemic concern embedded in software engineering processes. This shift requires not only revisiting computing curricula and promoting continuous training, but also redefining development practices, improving tool support, and fostering organizational cultures that prioritize inclusive design.

Finally, this work opens several opportunities for future research. In particular, there is a need for the design of integrated approaches, models, and tools that explicitly address the barriers identified in this work and support developers throughout the development lifecycle. In addition, further investigation is needed to understand how emerging technologies, such as Artificial Intelligence, can effectively support the implementation and validation of accessibility requirements in real-world development contexts.

Artifact Availability

All the artifacts created by our study are available in the following repository: https://doi.org/10.5281/zenodo.21421265.

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References

[1] 2015. Lei nº 13.146, de 6 de julho de 2015: Institui a Lei Brasileira de Inclusão da Pessoa com Deficiência (Estatuto da Pessoa com Deficiência). https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13146.htm
[2] Asmaa Alghamdi, Wajdi Aljedaani, Stephanie Ludi, and Yasir Javed. 2025. Automating Accessibility Compliance: Leveraging Machine Learning to Analyze

Developer Challenges with WCAG Guidelines. 61–66. doi:10.1109/CDMA61895.2025.00016

[3] Asmaa Mansour Alghamdi, Wajdi Aljedaani, Hamed Jalali, Stephanie Ludi, and Marcelo M. Eler. 2024. Understanding developer challenges and trends in web accessibility: a stack overflow analysis. *Univers. Access Inf. Soc.* 24, 2 (Nov. 2024), 1701–1717. doi:10.1007/s10209-024-01174-3

[4] Zainab AlMeraj, Dari Alhuwail, Rumana Qadri, Shok Shama, and Michael Crabb. 2023. Understanding mindsets, skills, current practices, and barriers of adoption of digital accessibility in Kuwait's software development landscape. *Univers. Access Inf. Soc.* 23, 3 (March 2023), 1427–1446. doi:10.1007/s10209-023-00980-5

[5] Humberto Lidio Antonelli, Sandra Souza Rodrigues, Willian Massami Watanabe, and Renata Pontin de Mattos Fortes. 2018. A survey on accessibility awareness of Brazilian web developers. In *Proceedings of the 8th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-Exclusion* (Thessaloniki, Greece) *(DSAI '18)*. Association for Computing Machinery, New York, NY, USA, 71–79. doi:10.1145/3218585.3218598

[6] Renan Aranha, Cleon Pereira Júnior, Filipe Portilho, Lucas Ribeiro, Newarney Costa, Ryan Correa, and Anne Ferreira. 2024. Dos documentos pedagógicos à sala de aula: perspectivas e práticas docentes sobre acessibilidade digital durante a formação em Computação. (2024), 774–784. doi:10.5753/wei.2024.3000

[7] Simone D. J. Barbosa, Silvia Amélia Bim, Clodis Boscarioli, and Milene S. Silveira. 2014. Desafios do ensinar para enfrentar os desafios de IHC. In *Proceedings of the 13th Brazilian Symposium on Human Factors in Computing Systems* (Foz do Iguaçu, Brazil) *(IHC '14)*. Sociedade Brasileira de Computação, BRA, 461–464.

[8] Simone Diniz Junqueira Barbosa, Bruno Santana da Silva, Milene Selbach Silveira, Isabela Gasparini, Ticianne Darin, and Gabriel Diniz Junqueira Barbosa. 2021. *Interação Humano-Computador e Experiência do Usuário.* Autopublicação.

[9] Alex Ramos Barboza and Marcelo Eler. 2025. VisioAux: a crowdsource approach for accessibility evaluation in mobile devices. In *Anais do XXIV Simpósio Brasileiro sobre Fatores Humanos em Sistemas Computacionais* (Belo Horizonte/MG). SBC, Porto Alegre, RS, Brasil, 446–473. doi:10.5753/ihc.2025.10794

[10] Tingting Bi, Xin Xia, David Lo, John Grundy, Thomas Zimmermann, and Denae Ford. 2022. Accessibility in Software Practice: A Practitioner's Perspective. *ACM Trans. Softw. Eng. Methodol.* 31, 4, Article 66 (July 2022), 26 pages. doi:10.1145/3503508

[11] Brasil. Governo Federal. 2014. *eMAG – Modelo de Acessibilidade em Governo Eletrônico.* Ministério do Planejamento, Orçamento e Gestão. https://emag.governoeletronico.gov.br/

[12] Milton Campoverde-Molina and Sergio Luján-Mora. 2026. Artificial intelligence in web accessibility: A systematic mapping study. *Computer Standards Interfaces* 96 (2026), 104055. doi:10.1016/j.csi.2025.104055

[13] Jacob Cohen. 1960. A coefficient of agreement for nominal scales. *Educational and Psychological Measurement* 20, 1 (1960), 37–46.

[14] Ryan Correa, Nathalia Teixeira, Filipe Portilho, Cleon Pereira Junior, and Renan Aranha. 2023. A formação em Computação e a (falta de) acessibilidade em sistemas computacionais: acaso ou resultado?. In *Anais do XXXI Workshop sobre Educação em Computação* (João Pessoa/PB). SBC, Porto Alegre, RS, Brasil, 488–498. doi:10.5753/wei.2023.230244

[15] Erik Henrique Da Costa Nunes, Guilherme Vital Ribeiro, Ingrid Teixeira Monteiro, and Enyo Gonçalves. 2024. Digital Accessibility at the Brazilian Symposium on Human Factors in Computing Systems (IHC): An Updated Systematic Literature Review. , Article 51 (2024), 15 pages. doi:10.1145/3638067.3638075

[16] Luís André da Silveira, Wajdi Aljeedani, and Marcelo Medeiros Eler. 2024. Strategic Insights into Integrating Accessibility in Software Development: Motivations, Barriers, Commitments, and Business Value. In *Proceedings of the XXIII Brazilian Symposium on Human Factors in Computing Systems (IHC '24)*. Association for Computing Machinery, New York, NY, USA, Article 69, 14 pages. doi:10.1145/3702038.3702108

[17] Victor Leal de Almeida and Kiev Gama. 2021. Mobile Accessibility Guidelines Adoption under the Perspective of Developers and Designers. In *2021 IEEE/ACM 13th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)*. 127–128. doi:10.1109/CHASE52884.2021.00028

[18] Tatiany Xavier de Godoi, Guilherme Corredato Guerino, and Natasha Malveira C. Valentim. 2021. Evaluation of Assistive Technologies from the perspective of Usability, User Experience and Accessibility: a Systematic Mapping Study. In *Proceedings of the XX Brazilian Symposium on Human Factors in Computing Systems* (Virtual Event, Brazil) *(IHC '21)*. Association for Computing Machinery, New York, NY, USA, Article 22, 10 pages. doi:10.1145/3472301.3484323

[19] Carie Fisher, Sunghyun Kang, and Cyndi Wiley. 2023. *Awareness, Understanding, and Attitudes of Digital Accessibility in Technology Professionals.* 277–283. doi:10.1007/978-3-031-35992-7_38

[20] Andre P. Freire, Cibele M. Russo, and Renata P. M. Fortes. 2008. A survey on the accessibility awareness of people involved in web development projects in Brazil. In *Proceedings of the 2008 International Cross-Disciplinary Conference on Web Accessibility (W4A)* (Beijing, China) *(W4A '08)*. Association for Computing Machinery, New York, NY, USA, 87–96. doi:10.1145/1368044.1368064

[21] G3ict – Global Initiative for Inclusive ICTs. 2020. *DARE Index 2020: Top Performing Countries – Digital Accessibility Rights Evaluation Index.* Technical Report. G3ict – Global Initiative for Inclusive ICTs. https://g3ict.org/upload/accessible_DARE-Index-2020-Top-Performing-Countries-ENGLISH-1.pdf Accessed: 2026-07-16.

[22] Yavuz Inal, Frode Guribye, Dorina Rajanen, Mikko Rajanen, and Mattias Rost. 2020. Perspectives and Practices of Digital Accessibility: A Survey of User Experience Professionals in Nordic Countries. In *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society* (Tallinn, Estonia) *(NordiCHI '20)*. Association for Computing Machinery, New York, NY, USA, Article 63, 11 pages. doi:10.1145/3419249.3420119

[23] Yavuz Inal, Kerem Rızvanoğlu, and Yeliz Yesilada. 2019. Web accessibility in Turkey: awareness, understanding and practices of user experience professionals. *Univers. Access Inf. Soc.* 18, 2 (June 2019), 387–398. doi:10.1007/s10209-017-0603-3

[24] Amila Indika, Christopher Lee, Haochen Wang, Justin Lisoway, Anthony Peruma, and Rick Kazman. 2025. Exploring Accessibility Trends and Challenges in Mobile App Development: A Study of Stack Overflow Questions. In *Proceedings of the 57th Hawaii International Conference on System Sciences (HICSS)*. Hawaii International Conference on System Sciences. doi:10.24251/hicss.2025.885

[25] International Organization for Standardization. 2011. ISO/IEC 25010:2011 Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE) – System and software quality models. International Standard.

[26] Maria-Teresa Kaarakainen and Lotta Saikkonen. 2023. Remark on digital accessibility: educational disparities define digital inclusion from adolescence onwards. *Universal Access in the Information Society* 22 (2023), 1279–1292. doi:10.1007/s10209-022-00908-5

[27] Daniel Killough, Tiger F. Ji, Kexin Zhang, Yaxin Hu, Yu Huang, Ruofei Du, and Yuhang Zhao. 2025. XR for All: Understanding Developers' Perspectives on Accessibility Integration in Extended Reality. arXiv:2412.16321 [cs.HC] https://arxiv.org/abs/2412.16321

[28] Barbara Kitchenham, Stuart Charters, et al. 2007. Guidelines for performing systematic literature reviews in software engineering. (2007).

[29] Jozef Kulik and Paul Cairns. 2023. A Qualitative Investigation of Real World Accessible Design Experiences within a Large Scale Commercial Game Development Studio. 1–8. doi:10.1109/CoG57401.2023.10333178

[30] Manoel Victor Rodrigues Leite. 2020. *Um estudo sobre o conhecimento em acessibilidade digital entre desenvolvedores de aplicações móveis no Brasil.* Master's thesis. Universidade de São Paulo, São Paulo, Brazil. doi:10.11606/D.100.2020.tde-27032020-082040

[31] Manoel Victor Rodrigues Leite, Lilian Passos Scatalon, André Pimenta Freire, and Marcelo Medeiros Eler. 2021. Accessibility in the mobile development industry in Brazil: Awareness, knowledge, adoption, motivations and barriers. *Journal of Systems and Software* 177 (2021), 110942. doi:10.1016/j.jss.2021.110942

[32] Delvani Antônio Mateus, Carlos Alberto Silva, Arthur F. B. A. de Oliveira, Heitor Costa, and André Pimenta Freire. 2021. A Systematic Mapping of Accessibility Problems Encountered on Websites and Mobile Apps: A Comparison Between Automated Tests, Manual Inspections and User Evaluations. *Journal on Interactive Systems* 12, 1 (Nov. 2021), 145–171. doi:10.5753/jis.2021.1778

[33] Darliane Miranda and João Araujo. 2022. Studying industry practices of accessibility requirements in agile development. In *Proceedings of the 37th ACM/SIGAPP Symposium on Applied Computing* (Virtual Event) *(SAC '22)*. Association for Computing Machinery, New York, NY, USA, 1309–1317. doi:10.1145/3477314.3507041

[34] F. Nour, Y. Benslimane, and Z Yang. 2023. Managing Accessibility Requirements in Web Application Development Projects: The Perspectives from Research and the Industry. In *2023 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. 1733–1737. doi:10.1109/IEEM58616.2023.10406733

[35] Rohan Patel, Pedro Breton, Catherine M. Baker, Yasmine N. El-Glaly, and Kristen Shinohara. 2020. Why Software is Not Accessible: Technology Professionals' Perspectives and Challenges. (2020), 1–9. doi:10.1145/3334480.3383103

[36] Talita Cristina Pagani Britto Pichiliani and Ednaldo Brigante Pizzolato. 2019. A survey on the awareness of brazilian web development community about cognitive accessibility. In *Proceedings of the 18th Brazilian Symposium on Human Factors in Computing Systems* (Vitória, Espírito Santo, Brazil) *(IHC '19)*. Association for Computing Machinery, New York, NY, USA, Article 8, 11 pages. doi:10.1145/3357155.3358448

[37] João Ricardo dos S. Rosa and Natasha Malveira C. Valentim. 2020. Accessibility, usability and user experience design for visually impaired people: a systematic mapping study. In *Proceedings of the 19th Brazilian Symposium on Human Factors in Computing Systems* (Diamantina, Brazil) *(IHC '20)*. Association for Computing Machinery, New York, NY, USA, Article 5, 10 pages. doi:10.1145/3424953.3426626

[38] Parth Sane. 2021. A Brief Survey of Current Software Engineering Practices in Continuous Integration and Automated Accessibility Testing. 130–134. doi:10.1109/WiSPNET51692.2021.9419464

[39] Letícia Seixas Pereira and Carlos Duarte. 2025. Evaluating and monitoring digital accessibility: practitioners' perspectives on challenges and opportunities. *Univers. Access Inf. Soc.* 24, 3 (March 2025), 2553–2571. doi:10.1007/s10209-025-01210-w

[40] Barbara Cristina A. Silveira, Thiago Silva-de Souza, and Ana Regina C. da Rocha. 2018. Software Accessibility for Visually Impaired People: a systematic mapping

study. In *Proceedings of the XVII Brazilian Symposium on Software Quality* (Curitiba, Brazil) *(SBQS '18)*. Association for Computing Machinery, New York, NY, USA, 190–199. doi:10.1145/3275245.3275266

[41] Shari Trewin, Brian Cragun, Cal Swart, Jonathan Brezin, and John Richards. 2010. Accessibility challenges and tool features: an IBM Web developer perspective. In *Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility (W4A)* (Raleigh, North Carolina) *(W4A '10)*. Association for Computing Machinery, New York, NY, USA, Article 32, 10 pages. doi:10.1145/1805986.1806029

[42] Renata Vinadé, Natalya Goelzer, and Sabrina Marczak. 2025. On the Definition of a Method for Specifying Accessibility Requirements: Early Insights from a Focus Group with Practitioners'. In *Anais do XXXIX Simpósio Brasileiro de Engenharia de Software* (Recife/PE). SBC, Porto Alegre, RS, Brasil, 769–775. doi:10.5753/sbes.2025.11561

[43] Beat Vollenwyder, Klaus Opwis, and Florian Brühlmann. 2020. How Web Professionals Perceive Web Accessibility in Practice: Active Roles, Process Phases and Key Disabilities. In *Computers Helping People with Special Needs*, Klaus Miesenberger, Roberto Manduchi, Mario Covarrubias Rodriguez, and Petr Peňáz (Eds.). Springer International Publishing, Cham, 294–302.

[44] Yi Wang, Xiao Liu, Chetan Arora, John Grundy, and Thuong Hoang. 2025. Understanding VR Accessibility Practices of VR Professionals. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. Association for Computing Machinery, New York, NY, USA, Article 1249, 17 pages. doi:10.1145/3706598.3713927

[45] Shavindra Wickramathilaka, John Grundy, Kashumi Madampe, and Omar Haggag. 2025. Developer Perceptions on Utilising Low-Code Approaches to Build Accessible and Adaptive Applications for Seniors. arXiv:2508.02968 [cs.SE] https://arxiv.org/abs/2508.02968

[46] World Wide Web Consortium (W3C). 2018. *Web Content Accessibility Guidelines (WCAG) 2.1*. W3C. https://www.w3.org/TR/WCAG21/