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UNIVERSAL DESIGN FOR INFORMATION (UDI) IN DIGITAL LIBRARIES: PRINCIPLES, MODELS, AND PRACTICAL APPLICATIONS

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ABSTRACT

This chapter examines Universal Design for Information (UDI) as a fundamental paradigm for promoting inclusion, accessibility, and Informational Justice in digital libraries. Through a theoretical and conceptual approach, it analyzes the evolution of UDI and its articulation with human rights, accessibility policies, critical information literacy, and digital curation. Digital libraries are understood as sociotechnical environments in which technological, cultural, and organizational elements directly influence equity in access to knowledge. By discussing principles such as equity of access, simplicity, flexibility, perceptibility of information, and tolerance for error, the chapter highlights how these elements strengthen users' informational autonomy. It also addresses the role of inclusive metadata, interoperability, and international standards (WCAG, Dublin Core, Schema.org, FAIR/IDEIA, ISO 16363) in building accessible digital ecosystems. International reference models and structural and epistemological challenges faced by Brazilian institutions are examined, followed by practical recommendations for institutional repositories and Federal Network libraries. The chapter concludes that UDI transcends technical aspects, constituting an ethical and educational commitment that positions digital libraries as key environments for democratizing knowledge and fostering citizenship.

Keywords: Universal Design for Information; Accessibility; Digital inclusion; Informational justice; Digital libraries.

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INTRODUCTION

The accelerated transition from physical libraries to digital environments has brought significant progress in access to knowledge, but it has also exposed historical inequalities related to how different subjects interact with information systems. Although it is argued that digitization has broadened access, it has not, by itself, ensured effective conditions of use, comprehension, participation, and social appropriation of information.

Informational accessibility, understood as a human right, continues to be traversed by cognitive, technological, sensory, semantic, and sociocultural barriers that tend to intensify in digital environments not built under inclusive principles. In this context, Universal Design for Information (UDI) emerges as a contemporary and indispensable paradigm aimed at creating information systems that consider human diversity from their very conception.

The idea that information constitutes a public good, and that access to it is a structuring component of citizenship, implies recognizing that informational exclusion is also social exclusion. This perspective is conceptually close to Informational Justice, whose centrality lies in guaranteeing equitable conditions of access, participation, and the capacity for critical use of information, ensuring that no group is rendered invisible or left at the margins of cultural, educational, and technological practices.

In digital libraries—especially institutional repositories, university libraries, and scientific databases—the implementation of UDI becomes a strategic element not only for reducing inequalities but also for strengthening practices of digital curation, preservation, and ethical mediation of information.

Thus, this chapter analyzes the foundations, applications, and challenges of Universal Design for Information in digital libraries, discussing how this paradigm is articulated with accessibility, inclusion, and Informational Justice. The approach considers both the technical and the epistemological dimensions of UDI, discussing structuring principles, implementation models, inclusive metadata practices, institutional policies, and potentialities for Vocational and Technological Education (VTE). To this end, it engages with authors who problematize informational complexity (Lévy, 1999), sociotechnical apparatuses (Deleuze, 1992), critical mediation of information (Gasque, 2012; Campello, 2009; Dudziak, 2017), and digital preservation (Sayão, 2010; Alves; Tartarotti; Fujita, 2020), linking such reflections to international recommendations such as WCAG, FAIR/IDEIA, ISO 16363, UNESCO (2023), and the SDGs of Agenda 2030.

THEORETICAL FOUNDATIONS OF UNIVERSAL DESIGN FOR INFORMATION

The concept of Universal Design, originally formulated in the field of architecture by Ronald Mace, proposed that physical environments be planned to serve all individuals, regardless of their motor, sensory, or cognitive abilities. Over the past decades, this conception has expanded to digital

technologies, resulting in developments such as Universal Design for Learning (UDL) and Universal Design for Information (UDI).

In the informational context, UDI encompasses the creation of systems that, from their initial planning, consider human diversity, allowing multiple forms of perception, comprehension, and interaction with information.

The philosophical basis of UDI is aligned with an inclusive vision of society, grounded in principles of human rights and in the understanding of information as a public good. The perspectives of the UN and UNESCO on accessibility and social participation indicate that digital environments that exclude certain groups reinforce structures of inequality (UNESCO, 2023). Thus, the application of UDI in digital libraries goes beyond the technical domain, constituting a political, ethical, and educational act.

Moreover, UDI dialogues with conceptions of informational mediation present in the fields of Librarianship and Information Science. Mediation—understood as a process involving interaction, interpretation, and construction of meaning—presupposes that subjects relate to information based on different cultural and cognitive repertoires. Gasque (2012) and Campello (2009) indicate that information literacy does not reduce to instrumental mastery; it demands the creation of conditions for critical autonomy, for the capacity to judge sources, interpret discourses, and understand structures of power. When the design of an information system prevents certain groups from accessing or comprehending content, this mediation process is disrupted, reinforcing epistemic inequalities.

Thus, UDI constitutes a natural extension of critical mediation, insofar as it enables digital libraries to be configured as inclusive spaces capable of accommodating people with different conditions of vision, hearing, cognition, digital literacy, cultural repertoires, and levels of informational autonomy. It is also connected to digital curation, in that preservation, description, dissemination, and use of digital objects are fully realized only when accessible to all.

DIGITAL LIBRARIES AS SOCIOTECHNICAL ENVIRONMENTS

Understanding digital libraries as sociotechnical environments makes it clear that they are not merely neutral repositories of documents but complex systems in which technologies, subjects, policies, languages, and cultural practices are intertwined. Deleuze (1992) argues that modern institutions configure technologies of power that shape modes of existence, which allows us to understand the digital library as a space of disputes, technical choices, and social responsibilities.

Within this sociotechnical ecosystem, UDI not only expands accessibility but repositions the library as an institution that promotes equity and citizenship. By becoming accessible, it reduces power asymmetries and contributes to the exercise of Human Rights, reinforcing transparency, public access to information, and democratic participation. Agenda 2030—especially SDGs 4 (quality education), 9

(resilient infrastructure and innovation), 10 (reduction of inequalities), 16 (effective and inclusive institutions), and 17 (partnerships)—strengthens this alignment by recognizing the role of information in building fairer societies.

UDI is also articulated with Open Science, whose fundamental principle is that the results of scientific production—data, articles, software, methodologies—must be accessible, reusable, and comprehensible to all. However, as Pinfield et al. (2015) point out, openness does not automatically equate to inclusion: without cognitive, technical, and semantic accessibility, vulnerable populations remain excluded.

Thus, digital libraries become strategic environments for articulating UDI and Open Science, strengthening practices of digital inclusion, collaborative curation, and citizen participation.

PRINCIPLES OF UNIVERSAL DESIGN FOR INFORMATION APPLIED TO DIGITAL LIBRARIES

Incorporating UDI into digital libraries involves adopting specific principles that guide the design of accessible, equitable, and intuitive information systems. When applied to the library context, such environments should offer multiple forms of navigation, interaction, and appropriation of content.

The principle of equity of access requires that all users be able to use the digital library under equivalent conditions, regardless of disability, age, digital literacy, or technological circumstances. This includes compatibility with screen readers, keyboard navigation, alternative descriptions, adequate contrasts, and straightforward navigation paths.

Flexibility of use refers to the capacity of the digital library to adapt to different user profiles and modes of interaction, allowing, for example, enlargement of fonts, interface personalization, use of textual and audiovisual versions, and offering content in multiple formats.

Simplicity and intuitiveness involve minimizing unnecessary complexities and reducing cognitive load, which benefits both persons with disabilities and users who are new to the digital environment.

Perceptible information means that all content must be presented in formats detectable by people with different sensory abilities, ensuring communicative equivalence.

Tolerance for error implies creating interfaces that prevent failures and assist in recovering from mistaken actions, especially in search systems, forms, and downloads.

Low physical and cognitive effort promotes interfaces that do not require precise movements, manual strength, or complex reasoning for simple actions.

Finally, accessible dimensions and spaces—transposed to the digital realm—refer to designing interfaces compatible with multiple devices, with appropriately sized buttons and clickable areas, ensuring comfort and efficiency.

When incorporated simultaneously, these principles constitute the foundation of a truly inclusive digital library.

INTEROPERABILITY, METADATA, AND ACCESSIBILITY

Informational accessibility depends not only on the interface but also on the quality of descriptive and technical metadata. The description of a digital object determines how it will be found, interpreted, and reused. Therefore, inclusive metadata will become an essential strategy for UDI.

Standards such as Dublin Core, MARC, RDA, Schema.org, and DataCite can incorporate properties aimed at accessibility, such as alternative text, audio description, transcription, identification of language, format, extent, cognitive accessibility, and type of mediation.

Furthermore, descriptions sensitive to linguistic and cultural diversity help reduce biases and discriminatory representations. As Lyman and Varian (2003) indicate, the information explosion makes it urgent to adopt standards that allow relevant information to be located without increasing inequalities of visibility.

Interoperability—an organizing axis of Open Science—is also related to UDI. Interoperable systems enable digital objects to circulate across different platforms, reaching diverse audiences. Without accessibility standards, however, this circulation becomes limited. Thus, digital libraries that wish to integrate networks such as RCAAP, OpenAIRE, LA Referencia, or SciELO need to incorporate accessible metadata, ensuring equity in the use of information.

MODELS AND GOOD PRACTICES OF UDI IN DIGITAL LIBRARIES

Some international institutions offer inspiring models for applying UDI. Europeana, for example, adopts standards of inclusive cultural description and provides automated accessibility tools. The UN develops multilingual, intuitive digital libraries with accessible metadata and guidelines for cultural diversity. Arca (FIOCRUZ) stands out for the clarity of its interface and the quality of its description, adopting accessibility policies within the scope of health. RepositóriUM (UMINHO) has developed digital inclusion functionalities aligned with the RCAAP ecosystem.

These models show that incorporating UDI is not an isolated action, but a continuous process that involves institutional policies, team development, technical reviews, and an organizational culture oriented toward equity..

STRUCTURAL AND EPISTEMOLOGICAL CHALLENGES

Implementing UDI faces significant structural barriers. Many digital libraries lack accessibility policies, specialized teams, or technological resources to redesign their systems. The absence of

institutional regulations, combined with a lack of political recognition of accessibility as a right, compromises progress.

There are also epistemological challenges: the information field has historically rendered invisible vulnerable groups—persons with disabilities, traditional communities, peripheral populations, subjects with low digital literacy. Digital libraries designed under an exclusively technocratic logic tend to reproduce these exclusions, reinforcing epistemic hierarchies.

Informational Justice, in this sense, constitutes a fundamental horizon. It requires that digital libraries problematize structuring inequalities and adopt practices that guarantee not only access but the effective participation of all in the construction, circulation, and appropriation of information..

PRACTICAL APPLICATIONS FOR BRAZILIAN LIBRARIES AND INSTITUTIONAL REPOSITORIES

Incorporating the principles of Universal Design for Information (UDI) into Brazilian libraries and institutional repositories requires a strategic, systemic, and interdisciplinary approach capable of transforming not only informational products but also the processes of curation, mediation, and information management. In the national context—especially in public teaching and research institutions—adopting UDI implies building institutional policies that ensure informational accessibility as a right, an ethical commitment, and a structuring component of digital governance.

In this regard, the initial need to develop formal policies for informational accessibility stands out, defining responsibilities, workflows, and minimum standards to be met by different sectors of the institution. Reviewing Standard Operating Procedures (SOPs) for digital curation thus becomes an essential step, as it makes it possible to incorporate specific UDI guidelines into processes of ingest, processing, preservation, and dissemination of digital content. This review should dialogue with national regulatory frameworks, Open Science guidelines, and international accessibility directives, strengthening an institutional culture of inclusion.

Another fundamental action involves mapping technological, communicational, and cognitive barriers that hinder diverse audiences from accessing digital content. This diagnosis guides more precise interventions, such as adapting interfaces, choosing accessible formats, and implementing assistive resources. For this, it is essential to invest in the continuing education of librarians, faculty, IT teams, and other professionals involved, articulating technical, pedagogical, and sociocultural competencies for a practice more attuned to diversity.

The technical dimension of UDI also requires attention to the incorporation of accessibility metadata into the records of repositories and digital libraries, which favors the discovery of accessible materials and improves interoperability among systems. Complementarily, it is recommended to develop

ingest checklists that include validations of audio description, captions, alternative texts, contrasts, navigability, and other elements essential to equitable access to information.

Continuous evaluation of interfaces is likewise indispensable. This evaluation should involve users with different profiles and conditions, making it possible to identify weaknesses and guide iterative improvements. Moreover, the adoption of UDI can be strengthened by articulation with the Sustainable Development Goals (especially SDGs 4, 9, 10, and 16) and with Open Science agendas, reinforcing its strategic, institutional, and social character.

Within the Federal Network of Professional, Scientific, and Technological Education, integrating UDI into Vocational and Technological Education (VTE) presents even broader opportunities. Libraries can promote workshops on inclusive information literacy, critical training in curation and cultural mediation, as well as technological accessibility projects that involve students, faculty, and support teams.

These actions strengthen libraries and repositories as spaces for learning, citizenship, and innovation, aligned with the public mission of democratizing knowledge.

FINAL CONSIDERATIONS

Universal Design for Information is consolidated as an essential paradigm for digital libraries committed to equity, citizenship, and social justice. By incorporating principles of accessibility, flexibility, simplicity, tolerance for error, and cultural diversity, UDI broadens the social reach of information, strengthens critical mediation, and reduces historical inequalities in access.

More than a technical guideline, UDI constitutes an ethical commitment that repositions digital libraries as sociotechnical environments of transformation, dialogue, and democratic participation. Its adoption strengthens Open Science, Vocational and Technological Education, Human Rights, and the Sustainable Development Goals—especially those related to inclusion, innovation, and justice.

Thus, promoting Universal Design for Information is to promote Informational Justice. It is to recognize that the true democratization of knowledge is not achieved solely through the availability of digital content, but through guaranteeing that all people can understand, use, and reinvent such content as part of their social, educational, and cultural trajectories. It is within this horizon that Brazilian libraries and institutional repositories find their contemporary mission: to be accessible, critical, welcoming, and, above all, profoundly human spaces..

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