eOftalmo

UPDATE ARTICLE

Promoting access by visually impaired people to digital technologies on cell phones, tablets, and computers

Promoção de acesso da pessoa com deficiência visual às tecnologias digitais em celulares, tablets e computadores

Ana Carolina Fava Salata[1], Maria Aparecida Onuki Haddad[2], Alex H. Higashi[2], Breno Marchiori Magalhães[2]

1. Setor de Reabilitação Visual/Visão Subnormal, Clínica Oftalmológica, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.
2. Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

KEYWORDS:

Digital accessibility; Visually impaired individuals; Assistive technology; Social inclusion; Mobile devices.

ABSTRACT

The inclusion and rehabilitation of visually impaired people depends on a multidisciplinary approach and equitable access to digital technologies, which are essential in contemporary society. Although cell phones, tablets, and computers are widely used, accessibility barriers still limit the participation of these individuals in the digital environment. Visual impairment affects millions of people worldwide and directly impacts education, occupation, and quality of life, thereby making digital accessibility a critical factor for guaranteeing equal opportunities. Assistive technology resources such as screen readers, image magnification, voice commands, Braille displays, and artificial intelligence-based applications promote autonomy and functionality, but their use is still not widespread. In addition to the technical constraints, insufficient training among users and professionals and inadequate enforcement of legislation hinder the effective realization of the legally guaranteed rights. Therefore, the promotion of digital accessibility requires the integration of technology, education, public policies, and ongoing social commitment.

PALAVRAS-CHAVE:

Acessibilidade digital; Pessoas com deficiência visual; Tecnologia assistiva; Inclusão social; Dispositivos móveis.

RESUMO

A inclusão e a reabilitação de pessoas com deficiência visual dependem de uma atuação multidisciplinar e do acesso equitativo às tecnologias digitais, fundamentais na sociedade contemporânea. Embora celulares, tablets e computadores sejam amplamente utilizados, barreiras de acessibilidade ainda limitam a participação plena desse público no ambiente digital. A deficiência visual afeta milhões de pessoas no mundo e impacta diretamente a educação, o trabalho e a qualidade de vida, tornando a acessibilidade digital um elemento essencial para a igualdade de oportunidades. Recursos de tecnologia assistiva, como leitores de tela, ampliação de imagens, comandos por voz, displays braille e aplicativos baseados em inteligência artificial, promovem autonomia e funcionalidade, mas seu uso ainda é pouco difundido. Além das limitações técnicas, a falta de capacitação de usuários e profissionais e a aplicação insuficiente da legislação dificultam a efetivação dos direitos garantidos. Assim, a promoção da acessibilidade digital exige integração entre tecnologia, educação, políticas públicas e compromisso social contínuo.

Corresponding author: Ana Carolina Fava Salata. E-mail: acsalata@hotmail.com
Recebido em: March 2, 2026. **Aceito em:** March 16, 2026.
Funding: No specific financial support was available for this study. **Conflict of interest:** None of the authors have any potential conflict of interest to disclose.

How to cite: Salata AC, Haddad MA, Higashi AH, Magalhães BM. Promoting access by visually impaired people to digital technologies on cell phones, tablets, and computers. eOftalmo. 2026;12(2):51-55.

DOI: 10.17545/eOftalmo/2026.v12.0011

INTRODUCTION

The rehabilitation and inclusion of individuals with visual impairments rely on the collaborative efforts from professionals from various fields because loss of vision affects several aspects of life, ranging from supporting the overall development of children with visual impairments, who face socialization and education challenges, to adults and older individuals dealing with professional challenges and daily living activities[1,2].

The advent of digital technologies has significantly transformed communication, learning, work, and access to services, making cell phones, tablets, and computers essential tools in contemporary society. In this context, equal access to technology is a determining factor for social inclusion. However, visually impaired individuals still face obstacles that limit their full participation in the digital environment, specifically when systems and applications are not designed to be accessible[3].

Visual impairment, which ranges from low vision to total blindness, affects millions of people worldwide. According to the World Health Organization (WHO), visual impairment negatively impacts education, employment, and quality of life when adequate access conditions are unmet[4]. In this way, digital accessibility becomes an essential element in guaranteeing equal opportunities.

According to the World Wide Web Consortium (W3C), digital accessibility presupposes that individuals with disabilities can perceive, understand, navigate, and interact with the Web[5]. The W3C has created international guidelines—the Web Content Accessibility Guidelines (WCAG 2.1)—to guide the development of digital content to increase its accessibility for people with disabilities. In general, the WCAG 2.1 are based on four fundamental principles: to be perceivable, operable, understandable, and robust; these principles guide the development of digital interfaces that ensure a more inclusive access to information and digital technologies[5].

In this sense, assistive technology plays an essential role in enabling the adaption of devices and interfaces to the needs of visually impaired individuals.

In addition to the technological aspects, access to technology is guaranteed by legal frameworks. The Brazilian law on the Inclusion of Persons with Disabilities states that it is the right of individuals with disabilities to have access to information and communication on an equal basis with others[6]. However, the effective realization of this right still faces practical challenges.

Given this scenario, this article aims to analyze the challenges of and the strategies for promoting access to digital technologies by individuals with visual impairments, highlighting accessibility through cell phones, tablets, and computers as a tool for social inclusion.

Discussion

The WHO, through the World Report on Vision (2019), points out that visual impairment affects 2.2 billion people worldwide, of which around 1 billion cases could be avoided through prevention or relevant treatments. The WHO highlights that uncorrected visual impairment can significantly limit educational performance, employment opportunities, and quality of life[4].

According to the 2022 Brazilian Demographic Census, 7.3% (14.4 million) of the Brazilian population has some kind of disability, with visual impairment being the most prevalent (7.9 million people had visual impairment)[7]. Many of these patients do not have access to rehabilitation services near their homes, but they do have access to the Internet.

The 2025 data from the We Are Social website reveal that around 5.78 billion people in the world own a mobile device, and 5.56 billion individuals use the Internet[8]. In Brazil, 217 million people have a mobile device and 185 million people use the Internet, which is a total of 86.9% of the population[9]. According to IBGE/PNAD data from 2024, 90% of Brazilian homes have access to the Internet, and 88.9% of individuals over 10 years old have their own cell phone, with 96.7% of these using their cell phones to access the Internet[10].

In this context, digital accessibility plays a central role in social inclusion. For the W3C, accessibility means that individuals with disabilities can perceive, understand, navigate, and interact with the Web, as well as contribute to it[5]. This definition reinforces that accessibility is not only restricted to physical access to devices but also involves the way content and interfaces are designed.

As a result of technological advancements and increased access to the Internet, visually impaired individuals benefit from the help of microcomputers, cell phones, tablets, and applications to carry out their daily tasks; however, their use is not widespread.

The use of assistive technology is essential in the process of inclusion and rehabilitation of individuals with disabilities, as it promotes their autonomy and increases their functionality. Mary Pat Radabaugh famously quoted in 1993 that "for most people, technology makes things easier; for people with disabilities, technology makes things possible."

Computer resources for visually impaired people use interfaces that represent information through various senses: vision, hearing, and touch, and transform the information displayed on a screen[11]. In this way, they allow the enlargement or modification of the original image, vocalization of information with synthesized speech, and tactile representation of information through Braille with the aid of a Braille display.

Among the image magnification and/or modification features, computers, tablets, and cell phones offer basic settings in the accessibility menu such as choice of screen appearance, color filters or color inversion, changes to font size, screen magnification, changes to color and size of the mouse pointer, screen magnification, narration, and optical character recognition[12]. These features come at no extra cost and are a great solution for individuals with mild and moderate low vision. However, individuals with severe low vision often need greater magnification or voice resources.

Regarding mobile devices, VoiceOver (iOS) and TalkBack (Android) screen readers allow blind or low-vision users to navigate using gestures and sound feedback. These resources also offer access to essential services such as instant communication, distance learning, and banking. Voice assistants such as Alexa, Google Assistant, and Siri are additional resources. In Brazil, around 60% people use voice assistants on their devices, with Alexa being the most used assistant, according to an Ilumeo survey from 2025[13]. Regarding computers, screen reader software such as NVDA and JAWS play a central role in digital inclusion. These programs make it possible to read texts, navigate virtual environments, and use professional software. However, their efficacy depends directly on the correct structuring of pages and systems. Nielsen[14] highlighted the importance of accessible design stating that poorly designed interfaces increase cognitive load and make the use of technology more difficult for users with disabilities.

Both cell phones and computers can be connected to a Braille display, which allows part of the text and information displayed on the screen to be dynamically transcribed into Braille[2,15].

In the app stores of tablets and cell phones, we can find various software options that improve the experience of people with visual impairments. These include launcher-type apps, which modify the interface and increase the size of the icons, to apps that assist in urban mobility such as route creation, sound notifications for buses/subway/trains, descriptions of intersections (e.g., Moovit and Lazarillo), PDF readers, apps that convert any text to speech (e.g., Speechfy), and audiobooks[2]. With the development of artificial intelligence, there has been a revolution in cell phone applications that has provided wide accessibility through image description and text reading. Examples include Seeing AI, Be my Eyes, and Envision AI. It is thus of the utmost importance that rehabilitation professionals know their patients' visual function and subsequently present them with the most effective accessibility resources[2].

In addition to the technical barriers, insufficient training is a major obstacle. Many visually impaired individuals do not have access to adequate training on the use of the available accessibility resources, whereas technology professionals are often unaware of standards and guidelines on inclusion. A survey conducted by the McKinsey consultancy on digital skills in Brazil estimates that Brazilians lack knowledge on digital culture, defined as the development of mindsets and behaviors that enable learning through rapid testing, continuous improvement, and the use of digital technologies[2,16]. As the WHO points out, effective inclusion requires not only technological resources but also continuous education and awareness[4].

In legal terms, Brazil has regulatory instruments that guarantee the right to digital accessibility. The Brazilian Law on the Inclusion of People with Disabilities states that it is the duty of the state, society, and the family to ensure that people with disabilities have access to information and communication[6]. However, the literature shows that the implementation of these regulations still faces challenges, particularly in terms of adapting existing systems and monitoring compliance with the legislation.

Therefore, the development of technological accessibility for people with visual impairments requires an integrated approach that involves assistive technology resources, training for users and professionals, and the effective application of public policies. Promoting access to technology must be understood as a fundamental right and a collective commitment.

In conclusion, promoting the access to technology on cell phones, tablets, and computers by visually impaired individuals is an essential factor for digital and social inclusion. Despite technological advancements and the growing availability of assistive resources, there remain structural, educational, and design barriers that hinder the effective use of digital technologies by people with visual impairments.

Digital accessibility depends on not only the availability of assistive tools but also the development of suitable interfaces, compliance with accessibility guidelines, and the awareness of the professionals involved in the technological creation process. As pointed out, the absence of inclusive practices in the design and programming of digital systems contributes to exclusion and restricts the autonomy of people with visual impairments.

Moreover, the fundamental role of public policies and legislation in ensuring the right to access information and communication is highlighted. Although Brazil has advanced legislation in this respect, enforcing these regulations requires more supervision, investment, and educational measures. Training visually impaired users and making developers aware of the importance of accessibility are essential measures for promoting digital inclusion.

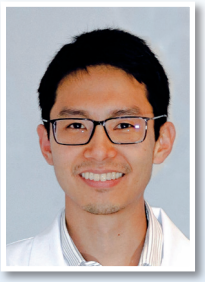
It can thus be concluded that promoting access to technology for visually impaired individuals must be understood as an ongoing, multidimensional process involving technological innovation, social responsibility, and ethical commitment. Investing in digital accessibility means to increase opportunities, strengthen citizenship, and contribute to building a fairer, more inclusive, and more equitable society. In this context, promoting digital accessibility for people with visual impairments is not just a matter of complying with technical or legal standards but also a commitment to the principles of the 2030 Agenda for Sustainable Development, especially the SDG 10 - Reducing Inequalities[17], by helping reduce barriers to the access to information, technology, and opportunities, ensuring that digital progress is truly inclusive and accessible to all.

REFERENCES

1. Sampaio MW, Haddad MAO. Baixa Visão: Manual para o Oftalmologista. Rio de Janeiro: Guanabara Koogan; 2009.
2. Higashi AH, Salata ACF, Sato RH. Desenvolvimento Tecnológico para Reabilitação e Inclusão da Pessoa com Deficiência Visual. In: Rey de Faria MA, Umbelino CC, Haddad MAO, Lavisnki J. Ações Sociais do CBO- São Paulo: CBO; 2024.
3. Lazar J, Goldstein D, Taylor A. Ensuring Digital Accessibility through Process and Policy. [internet]. Elsevier Science; 2015. Disponível em https://www.perlego.com/book/1809458/ensuring-digital-accessibility-through-process-and-policy-pdf.
4. World Report on Vision [internet]. Geneva: World Health Organization; 2019. Disponível em: https://www.who.int/publications/i/item/world-report-on-vision .
5. Web Content Accessibility Guidelines (WCAG) 2.1 [internet]; 2025. Disponível em https://www.w3.org/TR/2025/REC-WCA G21-20250506 .
6. 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). Diário Oficial da União, Brasília, 2015. Disponível em https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13146.htm .
7. Censo 2022: Brasil tem 14,4 milhões de Pessoas com Deficiência [internet]. Brasil, 2022. Disponível em: https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/43463-censo-2022-brasil-tem-14-4-milhoes-de-pessoas-com-deficiencia.
8. Global Overview Report 2026 [internet], 2025. Disponível em: https://wearesocial.com/us/blog/2025/10/digital-2026/.
9. Digital in Brazil [internet], 2025. Disponível em: https://datareportal.com/digital-in-brazil?utm_source=Global_Digital_Reports&utm_medium=Report&utm_campaign=Digital_2026&utm_content=Country_Link_Slide.
10. Internet Chega a 74,9 milhões de Domicílios do País em 2024 [internet] Brasil 2024. Disponível em: https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/44031-internet-chega-a-74-9-milhoes-de-domicilios-do-pais-em-2024.
11. Mortimer R. Recursos de Informática para Pessoas com Deficiência Visual. In: Haddad MAO, Sampaio MW, Susanna Jr R. Reabilitação em Oftalmologia. Barueri (SP): Manole, 2020.
12. Irvine D, Zemke A, Pusateri G, Gerlach I, Chun R, Jay WM. Tablet and Smartphone Accessibility Features in Low Vision Rehabilitation. Neuroophthalmology. 2014;38(2):53-59.
13. Assistentes Virtuais por Voz em 2025 [internet]. Brasil, 2025. Disponível em: https://ilumeo.com.br/marketing/estudo-assistentes-de-voz-e-oportunidades-para-marcas-2025.
14. Nielsen, J. Usability 101: Introduction to Usability. [internet] Fremont: Nielsen Norman Group, Jan 2012. Disponível em: https://www.nngroup.com/articles/usability-101-introduction-to-usability.
15. Mortimer RC. Recursos de Informática para Baixa Visão. In: Sampaio MW. Haddad MAO, Costa Filho HA, Siaulys MOC. Baixa Visão e Cegueira. Os Caminhos para Reabilitação, a Educação e a Inclusão. Rio de Janeiro: Guanabara Koogan; 2010 p. 221-300.
16. Martins H, Broide J, Castilho P, Dias Y. Habilidades Digitais no Brasil. O Potencial Digital dos Brasileiros: Diagnóstico e Oportunidades [internet]. McKinsey & Company; 2019. Disponível em: https://www.mckinsey.com.br/our-insights/habilidades-digitais-no-brasil.
17. Objetivos do Desenvolvimento Sustentável [internet]. Brasil, 2019. Disponível em: https://www.ipea.gov.br/ods/ods10.html.

AUTHOR INFORMATION

» **Ana Carolina Fava Salata**
http://lattes.cnpq.br/2005303838827986
http://orcid.org/0009-0004-8834-9684



» **Alex H. Higashi**
http://orcid.org/0009-0005-3094-7291
http://lattes.cnpq.br/8435292340225924

» **Maria Aparecida Onuki Haddad**
http://lattes.cnpq.br/8064114857983707
http://orcid.org/0000-0001-9949-8088

» **Breno Marchiori Magalhães**
http://lattes.cnpq.br/1408146095177380
http://orcid.org/0009-0009-8815-3784