Title

Decentering the Machine: Evaluating the Implementation, Accessibility, and Ethics of Emerging Technologies in Disability Spaces

Authors

Yanamandra, Bhavya
Prashanth, Sanjana
Ip, Gabriella
et al.

Publication Date

2026-08-25

Decentering the Machine: Evaluating the Implementation, Accessibility, and Ethics of Emerging Technologies in Disability Spaces

Authors: Bhavya Yanamandra, Sanjana Prashanth, Gabriella Ip, Sara Mattu, Dylan Nasori, Ebrar Oruc, Sabeeka Qureshi, Muzainah Uddin

University of California, Berkeley

ABSTRACT

This review explores the role of emerging technologies in advancing disability inclusion across education, healthcare, and daily life. Assistive technologies (AT) can provide greater independence and customized forms of support, yet their availability does not necessarily ensure meaningful access or inclusion. Relevant research on artificial intelligence (AI) and brain-computer interfaces (BCIs) demonstrates the potential of technological systems to expand communication and improve rehabilitation for individuals with severe neurological disabilities. However, access to these innovations is constrained by high costs, limited institutional support, and ethical challenges, including the risks of relying on systems that clinicians and users may not fully understand. Beyond these practical barriers, disability technologies may overlook individual needs or reinforce existing assumptions about disabled populations, potentially limiting their effectiveness in meeting users' needs. Taken together, this paper emphasizes that the value of disability technology cannot be measured solely by advances in development, but also by how it is implemented and whether the technology meaningfully responds to the needs of disabled individuals.

INTRODUCTION

People living with disabilities worldwide continue to face uneven access to the resources and support necessary for daily life. Assistive technology (AT), ranging from products like wheelchairs and hearing aids to digital communication tools, helps individuals with disabilities access education, healthcare, and social services that may otherwise be difficult to navigate. The scope of AT has expanded to include artificial intelligence (AI) and brain-computer interfaces (BCIs), creating new possibilities for personalized support beyond the innovation itself. These could allow patients to receive monitored rehabilitation at home while helping clinicians make better individual assessments. However, accessibility to these technologies remains a major challenge. Limited infrastructure, shortages of trained professionals, and concerns surrounding algorithmic bias and sensitive data collection significantly hinder implementation. Moreover, the effectiveness of disability technology depends not only on its abilities but also on successfully meeting the needs of the people it is intended for, raising concerns about whether emerging technologies can advance inclusion in diverse settings without creating new barriers.

DISCUSSION

In the landscape of emerging technologies for disability inclusion, a study by specialist Fernando Botelho, titled “Childhood and Assistive Technology: Growing with Opportunity, Developing with Technology,” highlights how assistive technology (AT) is an important resource for supporting children with disabilities during their development. Assistive technology includes devices such as wheelchairs, hearing aids, and communication tools that improve mobility, independence, and participation in daily life (Botelho et al., 2021). Despite the importance of these tools in child development, systemic failures in access can prevent millions of children from fully accessing essential services such as education, healthcare, and social support, leading to negative impacts on employment and quality of life. This research is especially relevant given that approximately 150 million children worldwide live with disabilities, while 48% of the countries examined lack formal policies supporting assistive technology (Botelho et al., 2021). The author states that accessibility barriers, such as the high cost of hearing aid batteries and the lack of disability ramps, can make assistive technologies ineffective even when they are available. Children also face unique challenges because their growth and development require assistive technologies to be replaced or adjusted more frequently (Botelho et al., 2021). To address these gaps, Botelho proposes a "Community-Based Inclusive Development" approach that involves community members in raising awareness, providing training, and developing resources. In this model, each person plays a unique role in supporting children with disabilities, while the primary goal remains centered on the specific needs of the child and their family (Botelho et al., 2021). Prioritizing early childhood intervention is essential for improving access to assistive technology and can provide long-term developmental benefits. However, scaling these solutions requires ethically collected, disaggregated national data that can identify barriers for policymakers while protecting privacy and avoiding the misrepresentation of smaller disability populations.

In the paper, "Integrating Artificial Intelligence in Supporting Students with Disabilities in Higher Education: An Integrative Review", researchers assessed current literature regarding the potential applications of artificial intelligence (AI) in higher education for students with disabilities. The paper addresses five themes: the benefits of AI assistance, personalized learning, challenges in technology adoption, institutional barriers, and best practices for AI implementation (Dumitru et al., 2025). Overall, incorporating AI technologies to support disabled students in higher education may be beneficial in terms of inclusivity and personalization, with 85% of students using AI-driven adaptive systems experiencing improvements in learning outcomes (Dumitru et al., 2025). However, much of the existing literature on AI in higher education overlooks special needs education. Other potential concerns, including algorithmic bias, privacy, and balancing traditional and technology-based teaching approaches, were also identified (Dumitru et al., 2025). Evidently, AI tools have demonstrated strong potential in supporting students with disabilities in higher education by providing more individualized learning experiences. Further research is necessary to better understand how these technologies can be implemented effectively while addressing existing barriers and maximizing their benefit for students with diverse needs.

Emerging technologies such as AI are redefining the landscape of disability support by transforming the accessibility, delivery, and individualization of mental health care. In their article, *Artificial Intelligence for Mental Health and Mental Illnesses: An Overview*, the authors argue that AI tools, including machine learning algorithms, conversational agents such as ChatGPT, and continuous digital monitoring systems, could allow mental health clinicians to expand care beyond generalized treatment models toward more personalized, data-informed approaches (Graham et al., 2020). Clinicians can use AI technologies to synthesize behavioral and clinical data to predict mental health risks earlier than traditional methods (Graham et al., 2020). This could provide critical support to individuals with disabilities who often encounter systemic barriers to accessing mental health care. However, the article also emphasizes significant ethical and structural concerns surrounding the use of AI in mental health care, particularly algorithmic bias, data privacy, and socioeconomic disparities in access to technological resources, all of which risk reinforcing existing systemic inequalities (Graham et al., 2020). Nevertheless, the findings suggest that when implemented responsibly, AI has the potential to expand the reach and responsiveness of mental health care while advancing accessibility, autonomy, and equity within the disability space.

Artificial intelligence continues to drive breakthroughs in disability care, particularly in adult stroke rehabilitation. A 2024 scoping review by Senadheera et al. analyzing 704 studies found that machine learning, computer vision, and natural language processing are progressively being applied to assess impairments, guide interventions, facilitate remote care, and predict long-term clinical outcomes. Telerehabilitation is one of the most promising developments, allowing patients to complete monitored therapy in the comfort of their homes by using wearable IoT (Internet of Things) sensors and computer vision (Senadheera et al., 2024). AI models can also identify recovery patterns that may not be easily perceived by humans, allowing clinicians to make more accurate and personalized evaluations (Senadheera et al., 2024). However, the high cost of specialized equipment, shortage of clinicians trained in both therapy and AI systems, and ethical concerns regarding the usage of sensitive patient data all create barriers to real-world implementation in disability spaces (Senadheera et al., 2024). Problems may also arise when clinicians are unable to fully understand how AI models process a given input due to the complex nature of these systems. As these technologies continue to develop, ensuring that AI serves as a tool rather than replacing the role of clinicians will be vital to its effective integration into healthcare.

Brain-computer interfaces, or BCIs, are emerging as a promising form of assistive and rehabilitative technology for people with disabilities, particularly for individuals whose mobility, communication, or cognition is limited by neurological conditions (Saha et al., 2026). In their 2026 review, Saha et al. explain that BCIs allow users to interact with external devices by translating brain activity into commands, which can support tools such as prosthetic arms, wheelchairs, communication systems, and neurostimulation devices. The article emphasizes that disability is not a “one size fits all” experience, so BCI technology must be individualized around each user’s functional abilities, personal needs, and environment (Saha et al., 2026). While BCIs could greatly expand independence and communication for people with severe disabilities, the review also raises concerns about accessibility, scalability, and the trade-offs between implantable and non-implantable systems. Implantable BCIs may offer more precise control, but they introduce concerns around surgical risk, informed consent, cost, and ethical use, especially for children or people with communication and cognitive disabilities (Saha et al., 2026). Overall, the review suggests that BCIs have strong potential to improve autonomy and quality of life, but the technology’s effectiveness will depend on whether it can be adapted to prioritize the needs of individual users while remaining equitable and ethical in implementation.

These broader applications of BCI technology are reflected in emerging innovations that have the potential to fundamentally reshape communication for people with severe disabilities. In her 2024 article, “New brain-computer interface allows man with ALS to ‘speak’ again”, Nadine A. Yehya examines a breakthrough system developed at UC Davis Health that translates neural signals into spoken language. In this study, a patient with amyotrophic lateral sclerosis (ALS) used 256 implanted electrodes to generate speech with up to 97.5% accuracy, even achieving 99.6% accuracy within a limited vocabulary after minimal training (Yehya, 2024). Unlike earlier assistive devices, this system allows for near real-time conversation, making communication more natural and improving the user’s quality of life (Yehya, 2024). This technology highlights the potential of BCIs to restore functional speech, identity, and autonomy for people with progressive neurological conditions. While promising, the study also raises important concerns about accessibility, as the invasive nature of brain implants and their likely cost may limit who can benefit from these advancements (Yehya, 2024). Additionally, because the BCI relies on decoding neural activity, it introduces possible ethical and privacy concerns regarding how brain data is stored and protected. This research suggests that while BCIs hold significant potential, their success will ultimately depend on addressing barriers related to equity, usability, and ethical implementation in the real world.

The current assistive-technology landscape is increasingly focused on creating cutting-edge solutions, yet these very technologies can decenter disabled people's needs and limit the roles they may assume, particularly within academia. "'I am just terrified of my future' – Epistemic Violence in Disability-Related Technology Research", Spiel et al. identify epistemic violence as a significant factor contributing to shortcomings in assistive technology while limiting opportunities for individuals to be recognized beyond their disabilities. The authors use anecdotal vignettes, including "a small child, cowering in a corner while a robot pursued them…" and a participant who described feeling ashamed during technology testing after being told, "'It's not you we're testing, it's the technology'" (Spiel et al., 2020). These examples illustrate the stark gap between the public perception of disability and how affected individuals actually experience it. Part of the discussion also explores how neurodiverse and disabled communities are often burdened with upholding inclusion and accessibility, even when these principles are incompatible with the current cultural landscape, pointing to an "extractive," one-sided relationship (Spiel et al., 2020). This is further reinforced by research that focuses on the shortcomings of disabled people rather than their strengths, reducing their complex and nuanced experiences to deficit-based representations. The paper questions why frustration and anger are so often directed toward disabled people and highlights the broader ethical and social implications of technologies that are supposedly designed for them (Spiel et al., 2020). This perspective forces stakeholders in the disability technology space to consider how their motivations, attitudes, and products may inadvertently reinforce bias and prejudice. Ultimately, the research underscores the need for disability technologies to center the experiences and perspectives of the people they are intended to assist.

CONCLUSION

Across assistive technology, artificial intelligence, and brain-computer interfaces, the literature demonstrates that meaningful benefits depend on whether innovations can be translated into practical, affordable, and individualized forms of support. At the same time, barriers such as cost and ethical concerns surrounding data and decision-making can prevent promising innovations from reaching the people who could benefit from them the most. The research presented in this paper also highlights the importance of recognizing disabled individuals as people with diverse needs and experiences rather than treating disability as a single, uniform condition. This places greater responsibility on developers, clinicians, researchers, and policymakers to consider how these systems function in practice and how effectively they respond to individual needs. Ultimately, the most meaningful progress may not come from developing the most advanced systems, but from creating a technological environment that promotes greater autonomy, comfort, and control in the lives of people with disabilities.

REFERENCES

1. Botelho, F. (2021, December 1). Childhood and Assistive Technology: Growing with opportunity, developing with technology. *National Center for Biotechnology Information*. https://pubmed.ncbi.nlm.nih.gov/34951821/

2. Dumitru, C., Muttashar Abdulsahib, G., Ibrahim Khalaf, O., & Bennour, A. (2025). Integrating artificial intelligence in supporting students with disabilities in higher education: An integrative review. *Technology and Disability*, *38*(1), 3–24. https://doi.org/10.1177/10554181251355428

3. Graham, S., Depp, C., Lee, E. E., Nebeker, C., Tu, X., Kim, H.-C., & Jeste, D. V. (2020). Artificial Intelligence for Mental Health and Mental Illnesses: An Overview. *Current Psychiatry Reports*, *21*(11). https://doi.org/10.1007/s11920-019-1094-0

4. Saha, S., Karlsson, P., Anderson, C., Kavehei, O., & McEwan, A. (2026). Individualized brain-computer interface for people with disabilities: A review. *Frontiers in Human Neuroscience*, *20*. https://doi.org/10.3389/fnhum.2026.1738876

5. Senadheera, I., Hettiarachchi, P., Haslam, B., Nawaratne, R., Sheehan, J., Lockwood, K. J., Alahakoon, D., & Carey, L. M. (2024). AI Applications in Adult Stroke Recovery and Rehabilitation: A Scoping Review Using AI. *Sensors*, *24*(20), 6585. https://doi.org/10.3390/s24206585

6. Spiel, K., Keyes, O., Williams, R. M., Good, J., Hornecker, E., & Bennett, C. L. (2020). “I am just terrified of my future” – Epistemic Violence in Disability Related Technology Research. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–16. https://doi.org/10.1145/3334480.3381828

7. Yehya, N. A. (2024). New Brain-computer interface allows man with ALS to “speak” again. *UC Davis Health*. https://health.ucdavis.edu/news/headlines/new-brain-computer-interface-allows-man-with-als-to-speak-again/2024/08