# A review of Challenges and Opportunities in the Adoption of Assistive Technology for Neurodiverse Learners

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## Abstract

This review explores the engagement of neurodiverse students with assistive technology (AT) across cognitive, behavioural, affective, and sociocultural dimensions. User-centred design emerges as a key factor in effective AT, with tools like Emotraductor, ReadIt, and WELI showcasing the benefits of personalisation. However, the research remains disproportionately focused on autism and dyslexia, overlooking other neurodiverse conditions such as dyspraxia and dyscalculia. Personalised AT has been shown to improve autonomy, educational outcomes, and engagement, but its effectiveness depends on comprehensive training and ongoing support. Ethical concerns, including data privacy, algorithmic bias, and the risk of overreliance on technology, require greater attention to ensure AT prioritizes the autonomy and well-being of neurodiverse learners. Future research should address these gaps by conducting longitudinal studies, incorporating culturally responsive AT designs, and fostering collaboration between educators, developers, researchers, and neurodiverse individuals to create inclusive and impactful solutions.

**Keywords :** Assistive technology, neurodiversity, user-centered design, Autism Spectrum Disorder (ASD), ADHD, inclusive education, adaptive learning, personalized tools, ethical considerations, autonomy-supportive practices, virtual learning environments (VLEs), wearable technology, culturally responsive design, longitudinal studies, educational outcomes.

## Introduction

Engagement with assistive technology (AT) for neurodiverse students encompasses various dimensions, including cognitive, behavioural, affective, and sociocultural aspects. These dimensions form a foundational framework for understanding how neurodiverse individuals interact with AT. This review explores current research, highlighting achievements, gaps, and future directions in the design, implementation, and impact of AT on neurodiverse students.

## User-Centered Design and Assistive Technology

User-centred design is critical for the success of AT but remains underexplored in research. Wang and Jeon (2024) emphasise the absence of requirement-driven design and standardised evaluation processes in AT for autistic adults. Addressing these gaps early in the design phase can enhance the effectiveness of AT tools. Several case studies demonstrate the value of tailoring technology to meet specific needs. Hervas, Mendz, and Bautista (2019) evaluated

tools like Emotraductor for emotion recognition and ReadIt, a web browser plugin for autistic individuals, finding that user-specific designs significantly improved outcomes. Similarly, Zheng (2021) highlights the potential of wearable technologies like smartwatches and the app WELI, which integrates behavioural interventions, reminders, and rewards, to provide discreet and effective support for neurodiverse students. However, McNicholl et al. (2021) argue that user engagement goes beyond design and must include comprehensive training and ongoing support to ensure effective utilization.

**The Complexity of Neurodiversity**

Neurodiversity encompasses a wide spectrum of neurological differences, such as ADHD, Autism Spectrum Disorder (ASD), and dyslexia. Gkora (2024) explores the integration of autonomy-supportive practices and AT in primary education, underscoring the importance of personalization. The study concludes that granting ADHD students greater control over their learning experiences significantly enhances educational outcomes. Nwachukwu, Azuka, and Wei et al. (2024) advocate for inclusive education that recognizes neurodiversity as a natural variation in human brain function. By tailoring instruction and leveraging AT, educators can create environments that unlock the potential of neurodiverse learners.

**Engagement and Pedagogy in Learning Environments**

Hite and Childers (2020) explore how students with neurodivergent conditions engage with virtual learning environments (VLEs) in science education. Their findings reveal that neurodiverse students value the sensory control and realistic simulations offered by VLEs but often struggle with features requiring sustained attention. Beyond the technical aspects, the psychosocial implications of AT are significant. Hand's (2023) research on presentation tools highlights both the empowering and challenging aspects of AT in academic and workplace settings. Further studies are needed to explore how AT can reduce stigma, foster belonging, and enhance self-esteem among neurodiverse students.

**Specificity of Assistive Technology**

The scope of assistive technology research is often limited to autism and dyslexia, overlooking other conditions like ADHD, dyspraxia, and dyscalculia. While tools like voice output communication aids (VOCAs) and communication software are welldocumented, a broader focus on AT, such as text-to-speech software, visual organizers, and adaptive learning platforms, is necessary to address the diverse needs of neurodiverse learners. Boyd, Day, and Stewart et al. (2018) emphasise that addressing sensory differences through AT design principles can maximise the potential of neurodiverse students. However, more comprehensive studies are required to understand how AT can support the full neurodiversity spectrum.

**Ethical Considerations**

Ethical concerns surrounding AT use are rarely addressed in the literature. Key issues include overreliance on technology, data privacy, and algorithmic bias. Researchers must ensure that AT implementation prioritises the autonomy and well-being of neurodiverse students while avoiding unintended negative consequences.

## Future Research Directions

To advance the field, research should prioritise the following, Longitudinal Studies examining the long-term impact of AT on academic, social-emotional, and employment outcomes—the Qualitative Insights aimed at gathering perspectives from neurodiverse students to inform user-centric AT design. The culturally responsive AT ensures AT tools are inclusive and sensitive to diverse cultural contexts. And collaborative development for engaging educators, researchers, developers, and neurodiverse individuals in creating AT solutions that are accessible and empowering.

## References


Azuka, C. V., Wei, C. R., Ikechukwu, U. L., & Nwachukwu, E. L. (2024). Inclusive instructional design for neurodiverse learners. *Journal of Digital Learning and Distance Education.*

Boyd, L. E., Day, K., Stewart, N., Abdo, K., Lamkin, K., & Linstead, E. (2018). Leveling the playing field: Supporting neurodiversity via virtual realities. *Technology and Innovation, 20*(1–2), 105–116. https://doi.org/10.21300/20.1-2.2018.105

Brown, E. T. (2016). The role of assistive technology in neurodiversity education. *Journal of Special Education Technology, 31*(1), 45–58.

Brunswick-Cole, K., Mallett, R., & Timimi, S. (Eds.). (2016). *Re-thinking autism: Diagnosis, identity and equality.* London: Jessica Kingsley Publishers.

den Houting, J., Higgins, J., Isaacs, K., Mahony, J., & Pellicano, E. (2021). "I'm not just a guinea pig": Academic and community perceptions of participatory autism research. *Autism, 25*(1), 148–163. https://doi.org/10.1177/1362361320951696

Hand, C. J. (2022). Neurodiverse undergraduate psychology students' experiences of presentations in education, and their anxiety relative to typical peers. *Journal of Applied Research in Higher Education.* https://doi.org/10.1108/JARHE-03-2022-0106

Hervás, R., Francisco, V., Méndez, G., & Bautista, S. (2019). A user-centred methodology for the development of computer-based assistive technologies for individuals with autism. *Lecture Notes in Computer Science*, 11746 LNCS, 85–106. https://doi.org/10.1007/978-3-030-29381-9_6

Hite, R., Childers, G., & Pereyra, M. (2021). Describing the experiences of students with ADHD learning science content with emerging technologies. *International Journal of Science Education, 43*(10), 1478–1501.

Holyfield, C., Drager, K. D. R., Kremkow, J. M. D., & Light, J. (2017). Systematic review of AAC intervention research for adolescents and adults with autism spectrum disorder. *Augmentative and Alternative Communication, 33*(4), 201–212. https://doi.org/10.1080/07434618.2017.1370495

Martinez, S. A., & Davis, M. E. (2017). Universal design for learning: A framework for supporting neurodiverse students. *International Journal of Inclusive Education, 11*(4), 367–382.

Mathy, Yorkston, K., & Guttman. (2000). Augmentative communication for individuals with amyotrophic lateral sclerosis. In Beukelman, D., Yorkston, K., & Reichle, J. (Eds.), *Augmentative and alternative communication disorders for adults with acquired neurologic disorders* (pp. 45–60). Baltimore: P. H. Brookes Publishing.

McNicholl, A., Casey, H., Desmond, D., & Gallagher, P. (2021). The impact of assistive technology use for students with disabilities in higher education: A systematic review. *Disability and Rehabilitation: Assistive Technology, 16*(2), 130–143. https://doi.org/10.1080/17483107.2019.1642395

Menon, A. (2019). Embracing neurodiversity: Pedagogical strategies for diverse learners. In *Confluence of curiosity: Multidisciplinary explorations in modern research* (Vol. 1, pp. 75–90).

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: Manual signs, graphic symbols, and voice output communication aids. *Language, Speech, and Hearing Services in Schools, 34*(3), 203–216. https://doi.org/10.1044/0161-1461(2003/017)

Puccini, A. M., & Chang, A. (2020). Acquiring educational access for neurodiverse learners through multisensory design principles. *Hackcessability Research Papers.*

Ryan, S., & Milton, D. (Eds.). (2016). *Critical autism studies: An introduction.* London: Jessica Kingsley Publishers.

Sinclair, J. (2010). Cultural commentary: Being autistic together. *Disability Studies Quarterly, 30*(1). https://doi.org/10.18061/dsq.v30i1.1075

Smith, R. (2006). Peer review: A flawed process at the heart of science and journals. *Journal of the Royal Society of Medicine, 99*(4), 178–182.

Snow, C. P. (1961). *The two cultures and the scientific revolution: The Rede Lecture 1959.* New York: Cambridge University Press.

Williams, P. J., & Thompson, L. H. (2019). Developing inclusive curriculum: Strategies for addressing neurodiversity. *Journal of Diversity in Higher Education, 12*(2), 89–104.

Zheng, H. (2021). Assisting young adults with neurodiversity to engage in learning activities: Smartwatch applications in inclusive education (Doctoral dissertation, George Mason University).