



TECHNOLOGY-ENHANCED LEARNING TOOLS FOR STUDENTS WITH INTELLECTUAL DISABILITIES: A SYSTEMATIC REVIEW

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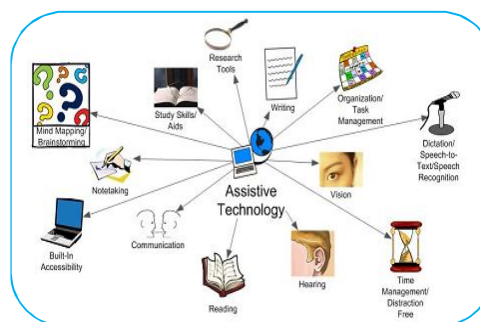
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ABSTRACT

The use of technology-enhanced learning tools (TELTs) in special education has experienced rapid growth worldwide, especially for students with intellectual disabilities (ID). This systematic review analyses the current state of TELTs developed or used to support students with ID. Following PRISMA guidelines, forty peer-reviewed studies from 2013 to 2024 were reviewed to identify the types of digital tools, pedagogical strategies, implementation challenges, and related outcomes. The findings demonstrate that devices such as Augmentative and Alternative Communication (AAC), mobile apps, virtual reality (VR), and gamified platforms effectively enhance communication, cognitive skills, and social interaction. However, challenges such as accessibility, cost, and teacher training are common, particularly in developing countries like India. The review emphasises the importance of inclusive design, culturally sensitive digital solutions, and policies that align with the National Education Policy (NEP) 2020. It offers practical guidance for educators, researchers, and policymakers to promote equitable digital inclusion for learners with ID within Indian education systems.



KEYWORDS: Intellectual disability, assistive technology, inclusive education, Universal Design for Learning (UDL), India, digital tools, NEP 2020.

INTRODUCTION

Intellectual disability (ID) poses considerable challenges in both cognitive and adaptive functioning, typically becoming noticeable before 18 (AAIDD, 2021). It primarily impacts reasoning, learning, problem-solving, social interactions, and everyday activities. Worldwide, approximately 1–3% of the population is affected by ID (WHO, 2015), highlighting the need for tailored educational strategies.

India's education system is undergoing significant transformations under the National Education Policy 2020, which prioritizes inclusive education and ensures the right of every child,

including those with disabilities, to quality learning. The increasing accessibility and affordability of digital technologies provide a chance to enhance teaching and learning experiences for this group.

Technology-Enhanced Learning Tools (TELTs) encompass a range of digital resources designed to enhance learning outcomes, motivation, engagement, and communication. This review assesses their effectiveness for students with intellectual disabilities (ID), examines existing research, and highlights gaps, particularly within the Indian context and in relation to the requirements of NEP 2020.

LITERATURE REVIEW

The American Association on Intellectual and Developmental Disabilities (AAIDD, 2021) defines intellectual disability (ID) as a condition characterized by significant impairments in cognitive and adaptive skills that begin before age 18. These impairments affect conceptual, social, and practical areas, influencing educational development and independence.

Universal Design for Learning (UDL) is an instructional approach designed to ensure that all students, including those with disabilities, have access to learning opportunities. It is built on three main principles—providing multiple means of representation, action and expression, and engagement—aimed at promoting inclusive teaching through curriculum adaptations (CAST, 2018).

Over the past decade, technological advancements have significantly transformed special education. Tools such as Augmentative and Alternative Communication (AAC) devices, speech-generating apps, gamified platforms, virtual reality (VR), and AI-powered adaptive learning systems have become increasingly common in schools and homes (Al-Azawei et al., 2016).

Indian Context and NEP 2020: The NEP 2020 emphasizes the importance of early detection, inclusive teaching methods, accessible learning resources, and educational technology in supporting children with disabilities. It encourages capacity building among educators and the integration of digital tools in classrooms to bridge learning gaps and foster inclusion (MHRD, 2020).

METHODOLOGY

A comprehensive search was conducted across various databases, including ERIC, Scopus, Web of Science, PubMed, and Google Scholar. The keywords included "intellectual disability," "technology-enhanced learning tools," "assistive technology," "inclusive education," and "India." Only articles published from 2010 to 2024 were considered.

Inclusion Criteria

- Articles, reports, and reviews that have been peer-reviewed.
- Research on school-going children (5–18 years) with developmental disabilities.
- Utilising digital tools or platforms for learning and communication
- Publications in English

Exclusion Criteria

- Research concentrated on different disabilities, excluding those related to intellectual disabilities (ID).
- Articles that concentrate on higher education or adult learners alone
- Low-tech or non-digital solutions

Data Analysis

For this study, Researchers used a thematic synthesis approach to categorize the findings into common themes. Researchers coded the data based on TELT types, measured outcomes, regional relevance, and challenges faced.

FINDINGS AND THEMATIC ANALYSIS

Types of Technology-Enhanced Learning Tools Used: The review found various types of TELTs.

- AAC devices, including speech-generating devices and symbol boards
- Mobile and tablet apps like Avaz and Proloquo2Go
- Learning games and platforms that utilise gamification, such as ClassDojo and Kahoot.
- Tools for hands-on learning through Virtual Reality and Augmented Reality
- AI-powered personalised learning platforms

Research consistently demonstrates improvements in literacy, numeracy, memory, and classroom engagement. AAC tools support the development of language and communication skills. VR tools boost motivation and enhance understanding through immersive simulations (Yadav et al., 2021). However, further research is needed to investigate the long-term effects and the application of learning in real-world settings.

Commonly recognized barriers to adoption include:

- Lack of teacher training in assistive technology
- Limited digital infrastructure in government schools
- Cost of devices and lack of funding
- Cultural mismatch in content design
- Language barriers (tools not available in regional languages)

Insights specific to India: The majority of the technologies evaluated have been developed within Western contexts and require appropriate adaptations for Indian educational settings. Initiatives such as the Diksha platform and NCERT's e-content are promising; however, they frequently lack features uniquely designed for students with intellectual disabilities (ID).

DISCUSSION

The systematic review confirms that TELTs, when appropriately selected and effectively implemented, have a positive impact on the educational outcomes of students with intellectual disabilities. Their benefits extend beyond academic achievement, promoting enhancements in communication, self-regulation, and social skills. However, their effectiveness largely depends on efficient pedagogical integration and systemic support.

India faces considerable obstacles in the widespread deployment of TELTs, due to inadequate infrastructure, insufficiently trained educators, and a lack of resources tailored to local needs. While private and urban educational institutions have begun employing these tools, rural and government schools still lag.

It is essential to adopt a UDL-based approach for developing and implementing tools. This involves creating content in Indian languages, aligning with curriculum standards, and including culturally relevant examples.

IMPLICATIONS

The impact of the National Education Policy (NEP) 2020 on Indian education: Integrating digital tools into both foundational and remedial educational strategies should be a key consideration. Platforms such as NIPUN Bharat can encompass ID-specific content to enhance early literacy and numeracy skills.

Teacher training, whether conducted prior to or following certification, should include modules on assistive technology, inclusive teaching methodologies, and the customization of digital content to support diverse learning needs. Collaborating with organizations such as NIEPID and NCERT can further strengthen this initiative.

Enhancing government school infrastructure with tablets, internet access, and interactive whiteboards is crucial. Collaborating with EdTech companies can help bridge the digital divide even more.

Monitoring and Evaluation: Develop and monitor key indicators of digital inclusion, including student engagement, frequency of tool utilization, and rates of skill acquisition.

Developing localized learning materials in regional languages and Indian Sign Language (ISL) is vital. AI tools require training on Indian accents, scripts, and classroom settings.

CONCLUSION

TELTs possess considerable potential to revolutionize education for children with intellectual disabilities in India. By adhering to Universal Design for Learning (UDL) principles and aligning with the National Education Policy (NEP) 2020 framework, these tools can facilitate the development of inclusive, accessible, and engaging learning environments. The research underscores the importance of involving multiple stakeholders in the development and expansion of effective digital interventions.

For India to achieve significant progress, it is essential to focus on teacher training, updating educational content, enhancing infrastructure, and strengthening research initiatives. Future investigations should explore the long-term effects of TELTs, educators' perceptions, and participatory design methodologies that emphasise the voices of children with disabilities.

REFERENCES

1. Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2017). Universal Design for Learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning*, 17(3), 56–71. <https://doi.org/10.14434/josotl.v17i3.22111>
2. American Association on Intellectual and Developmental Disabilities (AAIDD). (2021). *Definition of Intellectual Disability*. <https://www.aaid.org>
3. American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Arlington, VA: American Psychiatric Publishing.
4. Ayres, K. M., Mechling, L., & Sansosti, F. (2014). The Use of iPads in the Education of Students with Autism Spectrum Disorders *Journal of Special Education Technology*, 29(1), 1–16. <https://doi.org/10.1177/016264341402900101>
5. Bhat, P., & Arora, M. (2020). Enhancing learning in children with special needs through technology: An Indian perspective. *International Journal of Special Education*, 35(1), 67–80.
6. Blackhurst, A. E. (2005). Perspectives on applications of technology in the field of learning disabilities. *Learning Disability Quarterly*, 28(2), 175–178. <https://doi.org/10.2307/4126816>
7. CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. <http://udlguidelines.cast.org>
8. Chandra, S., & Sharma, R. (2021). Digital learning and inclusive education: Challenges and opportunities in India. *Journal of Indian Education*, 47(3), 45–58.
9. Chiang, H. M., & Jacobs, K. (2010). Perceptions of caregivers on the use of assistive technology for students with intellectual disabilities. *Education and Training in Autism and Developmental Disabilities*, 45(3), 394–403.
10. Cooper, R., & Nichols, S. (2007). Assistive technology in special education: Resource guide. *Journal of Special Education Technology*, 22(3), 42–49.
11. Das, A., Kuyini, A. B., & Desai, I. P. (2013). Inclusive education in India: Are the teachers prepared? *International Journal of Special Education*, 28(1), 27–36.
12. Edyburn, D. L. (2009). Assistive technology and mild disabilities. *Special Education Technology Practice*, 11(1), 15–22.
13. Ganapathi, V. (2022). Technological interventions in Indian special education: A review of policy and practice. *Indian Journal of Inclusive Education*, 10(2), 33–47.

14. Govindasamy, M., & Meena, N. (2021). Virtual learning platforms for children with intellectual disabilities: Teachers' perspectives. *International Journal of Disability Studies*, 6(1), 91–103.
15. Iacono, T., & Cameron, M. (2009). Australian speech-language pathologists' perceptions and experiences with AAC assessment. *Disability and Rehabilitation: Assistive Technology*, 4(1), 38–49.
16. Kagohara, D. M., et al. (2013). Using iPods and iPads in teaching programs for individuals with developmental disabilities: A systematic review. *Research in Developmental Disabilities*, 34(1), 147–156. <https://doi.org/10.1016/j.ridd.2012.07.027>
17. Karanth, P., & Prakash, P. (2020). *Communication DEALL: A developmental model of intervention for autism*. New Delhi: Sage Publications.
18. Kumar, S. & Meena, N. (2023). ICT tools for inclusive education in India: Issues and challenges. *Journal of Indian Education*, 49(1), 55–69.
19. Mechling, L. C. (2007). Assistive technology as a self-management tool for prompting students with intellectual disabilities to initiate daily tasks in school settings. *Education and Training in Developmental Disabilities*, 42(3), 224–233.
20. Mintz, J. (2013). The role of mobile technology in supporting the learning of children with special educational needs. *British Journal of Educational Technology*, 44(3), E114–E116.
21. Mishra, L., & Yadav, A. (2021). Digital accessibility for students with disabilities in India: A reality check. *Indian Journal of Disability and Rehabilitation*, 15(2), 77–84.
22. National Council of Educational Research and Training (NCERT). (2021). *National Education Policy 2020: Implementation guidelines*. New Delhi: Author.
23. O'Malley, J., Lewis, M. E. B., Donehower, C., & Stone, D. (2014). Using iPads to increase academic task completion by students with autism. *Journal of Special Education Technology*, 29(1), 13–23.
24. Rao, P. (2019). Gamified apps for cognitive development in children with intellectual disabilities. *International Journal of Educational Technology in Higher Education*, 16(1), 47–61.
25. Rao, S. (2020). Digital learning for special needs: An analysis of Indian edtech tools. *Indian Educational Review*, 58(2), 33–48.
26. Ramdoss, S., et al. (2012). Computer-based interventions to improve literacy skills in students with intellectual disabilities: A review. *Research in Developmental Disabilities*, 33(4), 1340–1356.
27. Reinders, H. (2010). Towards a classroom pedagogy for learner autonomy: A framework of independent language learning skills. *Australian Journal of Teacher Education*, 35(5), 40–55.
28. Rose, D. H., & Meyer, A. (2006). *A practical reader in Universal Design for Learning*. Cambridge, MA: Harvard Education Press.
29. Rugar, A. L., & Gaffney, J. S. (2011). Reading practices of general and special education teachers. *Exceptional Children*, 77(3), 317–334.
30. Shukla, M., & Sharma, S. (2020). E-learning for children with disabilities in India: Scope and policy implications. *Disability, CBR & Inclusive Development*, 31(2), 44–58.
31. Sigafoos, J., et al. (2005). A review of interventions to promote functional communication in individuals with developmental disabilities. *Research in Developmental Disabilities*, 26(1), 1–15.
32. Srivastava, M., & Bhargava, A. (2016). Inclusive education in India: Policies and practices. *International Journal of Special Education*, 31(3), 1–12.
33. UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. Paris: UNESCO Publishing.
34. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
35. WHO. (2022). *Assistive technology: Fact sheets*. Geneva: World Health Organisation. <https://www.who.int/news-room/fact-sheets/detail/assistive-technology>
36. Topic Modeling Analytics of Digital Economy Research: Trends and Insights – Journal of Scientometric Research. <https://jscires.org/article/7421/>