LEVERAGING DIGITAL TECHNOLOGY TO ENHANCE COGNITIVE AND FUNCTIONAL SKILLS OF LEARNERS WITH INTELLECTUAL DISABILITY

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Abstract

This research explores the application of digital technology in enhancing the cognitive and functional skills of learners with intellectual disabilities. As educational environments evolve, the integration of innovative technologies presents a unique opportunity to address the diverse needs of this population. Digital tools, such as interactive software, mobile applications, and virtual reality environments, offer tailored learning experiences that accommodate various learning styles and abilities. Using a systematic literature review study, the research highlights that these technologies can facilitate skill development in areas such as communication, problem-solving, and daily living activities. For instance, speech-generating applications can aid individuals in improving their verbal communication, while gamified learning platforms can engage learners in a dynamic and motivating manner. In addition, digital resources enable educators and caregivers to track progress and customise lesson plans, ensuring that each learner receives the support they require. Furthermore, the accessibility of technology is continually improving, making it easier for learners with intellectual disabilities to access these valuable tools.

Keywords: Digital Technology, Cognitive and Functional Skills, Learners with Intellectual Disability

INTRODUCTION

Intellectual disability (ID) is a neurodevelopmental disorder characterised by significant limitations in both cognitive functioning and adaptive behaviour, typically manifesting during the developmental period from birth to 18 years of age (American Association on Intellectual and Developmental Disabilities [AAIDD], 2021). An individual with this condition, according to Schalock (2011), may exhibit difficulty in cognitive processes,

including reasoning, problem solving, abstract thinking, and learning from experience, as well as functional skills such as communication, social participation, and independent living. Learners with ID may have difficulties acquiring academic knowledge at the same pace or complexity as their peers, thereby requiring a structured, supportive, and often individualised educational plan that considers their mental capability.

Developing cognitive and functional skills is vital for every person, no matter their intellectual ability. These skills shape how we learn, grow, and live meaningful lives. Cognitive abilities like attention, memory, and problem-solving lay the groundwork for learning and doing well in school.

Functional skills are everyday abilities, like communicating, managing money, and taking care of personal needs, that help people with ID live more independently and participate fully in their communities (Heward et al., 2017). Without these skills, learners may face difficulties not only in academics but also in building relationships, finding jobs, and managing daily life as they get older. Supporting the development of both thinking and practical life skills is crucial. With the right instruction and opportunities to practice, learners with ID gain confidence, feel included, and enjoy more meaningful lives. Teaching functional skills often involves direct, systematic instruction and real-world practice, both in classrooms and community settings, so learners can apply what they learn to real-life situations.

In recent years, digital technology has significantly transformed special needs education, making learning more accessible, engaging, and tailored to each learner's unique abilities. Teachers use these technologies to tailor instruction to meet each learner's needs, improve communication for those who struggle to express themselves, and make educational content more accessible (Knight et al., 2013). Learners experiencing reading difficulties can benefit from text-to-speech software, while communication gaps among non-verbal learners can be bridged using verbal communication applications (Rose & Meyer, 2006). The combination of traditional teaching with innovative technology can enhance classroom interaction between teachers and learners with ID, resulting in the development of skills needed for independence and improved quality of life. Some of the traditional barriers in special education, such as limited access to specialised instructors or time-consuming instructional methods, can be overcome using digital technology. Effective use of the tools will not only boost academic achievement but also contribute to improved social behaviour, emotional regulation, and self-determination among learners with ID (Lorah et al., 2022).

Intellectual Disability (ID), formerly referred to as mental retardation, is a neurodevelopmental disorder that is characterised by significant impairments in both intellectual functioning and adaptive behaviour (AAIDD, 2021) and originates before the age of 18. The condition influences multiple areas of daily life functioning. The term intellectual functioning, according to APA (2013), consists of problem-solving skills, planning, abstract thinking, judgment, academic learning, and learning from experience, while adaptive behaviour is the conceptual, social, and practical skills required for everyday living (Schalock & Luckasson, 2021).

A diagnosis of ID is classified under neurodevelopmental disorders by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). It is defined as deficits in general mental abilities and impairment in adaptive functioning, which contribute to failure to meet developmental and sociocultural standards for personal independence and social responsibility (APA, 2013). The DSM-5 categorises ID severity as mild, moderate, severe, or profound, based on adaptive functioning. Similarly, the World Health Organisation (WHO) uses the International Classification of Diseases (ICD-11) to define ID as a disorder of intellectual development characterised by significant limitations in intellectual functioning and adaptive behaviour, with onset before age 18 (WHO, 2019). The ICD-11 aligns closely with the DSM-5 in its emphasis on adaptive functioning across conceptual, social, and practical domains.

In both frameworks, assessment of ID involves standardised intellectual testing and adaptive behaviour measures, considering cultural and linguistic differences (Robertson et al., 2014). The inclusion of adaptive behaviour as a core criterion reflects a shift from earlier models that focused solely on intellectual quotient scores, thereby fostering a more holistic understanding of an individual's capabilities and needs (Maulik et al., 2011).

Learners with ID often experience a broad range of cognitive and functional challenges that hinder their academic and social development. These include limitations in memory, attention, processing speed, language development, executive functioning, and generalisation of skills (Turnbull et al., 2015). Deficits in these areas can significantly compromise the learner's ability to engage in typical classroom activities and to perform tasks that require reasoning and abstract thinking (Heward et al., 2017).

For instance, many individuals with ID have difficulty with working memory, which affects their capacity to retain and manipulate information in real-time, an essential skill for problem solving and following multi-step instructions (Swanson, 2011). Attention deficits are also prevalent, making it

difficult for learners to maintain focus over time or switch focus when necessary (Hallahan et al., 2020). These limitations often translate into slower rates of learning, a need for repetition, and greater dependency on structured and scaffolded instructional approaches.

Language and communication difficulties are also widespread. Many learners struggle with expressive and receptive language, impeding their ability to articulate their needs or comprehend instructions (Laws & Bishop, 2003). These communication challenges can, in turn, impact social interaction, leading to isolation and limited peer relationships (Matson & Shoemaker, 2011). Furthermore, deficits in adaptive functioning, such as self-care, money management, and mobility, present obstacles to independent living and community integration (AAIDD, 2021). Another common challenge is difficulty with generalising skills across contexts. For example, a learner may be able to perform a task in a classroom setting but fail to replicate the same task at home or in the community (Brown et al., 2016). This highlights the need for instruction that is both functional and contextually relevant, with opportunities for real-life practice and reinforcement.

The educational needs of learners with ID are multifaceted, encompassing not only academic content but also the development of functional life skills. These learners benefit from highly individualised education programmes (IEPs) that are tailored to their specific strengths, needs, and learning styles (Friend, 2018). Effective teaching strategies often include task analysis, direct instruction, systematic prompting, repeated practice, and positive reinforcement (Westling & Fox, 2009). Despite these known strategies, learners with ID often encounter several barriers in traditional learning environments. One of the most prominent barriers is the lack of inclusive practices that accommodate diverse learning needs.

Mainstream educational systems are frequently structured around a one-size-fits-all model that prioritises standardised testing and curriculum pacing, which does not align with the learning profiles of students with ID (Florian & Black-Hawkins, 2011). Consequently, these students may experience marginalisation, underachievement, and low self-esteem (Avramidis & Norwich, 2002). Another barrier is the limited availability of trained special education teachers and support staff. Many schools face shortages in personnel who are adequately prepared to deliver individualised instruction and manage the behavioural and emotional challenges that may accompany ID (Leko et al., 2015). Furthermore, general education teachers often report feeling unprepared and unsupported in their efforts to include students with ID in their classrooms (Sharma et al., 2012).

Physical and attitudinal barriers also play a role. Infrastructural limitations such as inaccessible buildings, a lack of assistive technology, and the absence of resource rooms can restrict participation (UNESCO, 2020). In addition, stigma and misconceptions about ID continue to influence teacher expectations and peer interactions, often resulting in lowered opportunities for meaningful inclusion (Scior, 2011).

Technology, when integrated thoughtfully, has the potential to mitigate many of these barriers by providing accessible, engaging, and customisable learning experiences. Digital tools can offer visual, auditory, and tactile stimuli that cater to diverse learning styles, and their interactive nature can enhance motivation and participation (Knight et al., 2013). Furthermore, technology can facilitate differentiated instruction, real-time feedback, and data-driven decision-making, which are essential for effective special needs education (Rose & Meyer, 2006).

The integration of digital technology into special education has significantly transformed how learners with ID engage with educational content and acquire cognitive and functional skills. Intellectual disability (ID) is associated with limitations in intellectual functioning and adaptive behaviour, affecting academic, social, and everyday life competencies (Schalock & Luckasson, 2021). These challenges often necessitate personalised interventions, which digital technologies are uniquely equipped to provide through adaptive learning, assistive tools, and multisensory platforms.

METHOD

The present study employed a systematic literature review, analyzing over 50 articles focused on the use of technology for learners with intellectual disabilities. The review aimed to identify current trends, effective strategies, and challenges in integrating technological tools to support learning. By synthesizing findings across multiple studies, the research provides a comprehensive understanding of how technology can enhance engagement, accessibility, and educational outcomes for students with diverse cognitive needs.

FINDINGS AND DISCUSSION

One of the most promising contributions of digital technology to the education of learners with ID is its capacity to support personalised learning.

Adaptive learning systems tailor instructional content to the learner's pace and ability, ensuring that tasks are neither too challenging nor too simplistic (Bouck & Flanagan, 2009). For instance, programmes like TeachTown and Vizzle adjust task complexity based on student responses, promoting mastery through repetition and immediate feedback (Knight et al., 2013). These platforms align with Universal Design for Learning (UDL) principles, which emphasise flexible learning environments and varied means of engagement (Rose & Meyer, 2006). Moreover, IEPs can be effectively integrated with educational software that tracks progress and adapts instruction accordingly. This functionality supports data-driven teaching, enabling educators to adjust goals and strategies in real-time (Edyburn, 2020).

Digital interventions play a crucial role in developing attention, memory, and executive functioning in learners with ID. Research has shown that digital games and apps designed for cognitive training can improve working memory and processing speed when used consistently (Ren et al., 2023; Torra Moreno et al., 2021). For instance, applications such as Cogmed and Lumosity, although developed for the general population, have been adapted in some special education settings to support children with ID (Rojas-Barahona et al., 2022). Gamified learning environments maintain attention through immediate reinforcement and interactive features, fostering sustained focus and task persistence (Yell et al., 2003). For students with ID who are often susceptible to distractibility, these environments offer structure and clarity, which are vital for cognitive engagement (Hallahan et al., 2020).

Communication difficulties are a core feature among many learners with ID. Augmentative and Alternative Communication (AAC) devices and software, such as Proloquo2Go and GoTalk NOW, provide vital means for expressive and receptive communication, especially for non-verbal individuals (Alzrayer & Banda, 2017). These tools use symbols, pictures, and speech synthesis to help users construct sentences and interact socially.

Speech-generating devices (SGDs) are especially beneficial for learners with complex communication needs. Studies show that learners using SGDs demonstrate improved communication initiation and reduced behavioural issues related to frustration (Lorah et al., 2018). Furthermore, video modelling – delivered through tablets or apps – can enhance language acquisition by allowing learners to observe and imitate correct language use (Bellini & Akullian, 2007).

Beyond academics, technology supports the development of daily living skills that are critical for independence. Applications such as Choiceworks and iDo Hygiene offer visual schedules, social stories, and step-by-step task guides

that help users with ID complete routines independently (O'Malley et al., 2014). These tools are invaluable for teaching self-care, time management, and money handling – skills that directly impact community inclusion and personal autonomy. In addition, virtual simulations and augmented reality (AR) have emerged as promising tools for practising real-world tasks in a safe, controlled environment. For example, learners can simulate crossing the street, shopping, or navigating public transportation – experiences that are otherwise difficult to orchestrate safely in real-time (Sigafoos et al., 2007).

Technology-based interventions also promote social development. Social skills applications such as Model Me Kids and Social Skill Builder provide video scenarios, interactive quizzes, and modelling to teach conversational turn-taking, emotional recognition, and appropriate social behaviour (Bond et al., 2021; Turner, 2017). These programmes often incorporate reinforcement and role-playing components, allowing learners to apply social rules in contextually relevant ways. Research supports the efficacy of video self-modelling in improving peer interaction and reducing disruptive behaviour (Regan & Howe, 2017). When learners with ID view videos of themselves performing socially desirable behaviours, they are more likely to repeat those behaviours in natural settings, contributing to positive peer relationships and classroom integration (Dowrick, 2012).

Digital technology also plays a vital role in facilitating inclusive education. Accessibility features such as text-to-speech, closed captioning, screen readers, and adjustable font sizes help ensure that learning materials are usable by all students, regardless of ability (Florian & Black-Hawkins, 2011). Platforms like Bookshare and Kurzweil 3000 allow students with ID to access grade-level texts with embedded support, thereby promoting curriculum access without compromising content. Inclusive technology supports differentiated instruction, allowing teachers to offer content in multiple formats – visual, auditory, and kinesthetic – thus accommodating diverse learning preferences (Gargiulo & Metcalf, 2017). This inclusion not only benefits students with ID but also enriches the learning experience for all students by fostering a culture of diversity and empathy.

Teachers and caregivers play a crucial role in the success of digital interventions. Digital platforms such as ClassDojo and Seesaw facilitate real-time communication between school and home, enabling parents to track their child's progress and engage in the learning process (Reichow et al., 2011). Many instructional apps come with built-in analytics that allow educators to monitor progress and adjust strategies based on individual needs. Professional development and training are essential to ensure that educators can effectively

use digital tools. Studies emphasise the need for ongoing support, technical assistance, and collaborative learning among educators to sustain technology implementation in special education settings (Leko et al., 2015).

Despite the advantages, the use of digital technology in special education also presents challenges. Accessibility and affordability remain significant barriers, particularly in low-resource settings (UNESCO, 2020). Moreover, without proper training, educators may struggle to integrate technology effectively, potentially leading to underuse or misuse (Sharma et al., 2012). Data privacy and ethical concerns regarding surveillance, consent, and screen time must also be addressed. Learners with ID are a vulnerable population, and their use of technology must be guided by safeguards that prioritise their well-being and dignity (Scior, 2011).

The integration of digital tools into educational frameworks has transformed how learners with ID access, process, and engage with content. These tools target core developmental areas, including cognition, functional skills, and communication, offering customisable and evidence-based interventions that promote greater autonomy, academic success, and quality of life (Al-Azawei et al., 2016). This section explores the most promising emerging technologies that support learners with ID across three key dimensions: cognitive skill enhancement, functional skill development, and communication and language support.

Cognitive skills such as attention, working memory, and executive functioning are essential for academic success and daily functioning. Learners with ID often experience delays in these areas, requiring structured interventions to support learning and problem solving (Wehmeyer & Shogren, 2017).

Numerous educational applications have been developed to address these cognitive deficits through repetitive, gamified practice and multisensory engagement. Tools like CogniFit, Lumosity, and BrainHQ have been used to strengthen working memory, attention span, and cognitive flexibility through personalised training programmes (Melby-Lervåg & Hulme, 2013; Owen et al., 2010). For example, Cogmed has demonstrated positive outcomes in enhancing attention and working memory in children with developmental delays, including ID (Anderson et al., 2018; Roording-Ragetlie et al., 2016).

Platforms such as ABCmouse, Starfall, and Khan Academy Kids provide interactive e-learning experiences tailored to early learners, including those with ID. These platforms use scaffolding strategies, immediate feedback, and visual prompts to reinforce foundational concepts in literacy, numeracy, and science (Bouck et al., 2014). The multisensory and interactive nature of these

tools improves sustained engagement and comprehension (Knight et al., 2013).

Gamification refers to the application of game elements in non-game contexts to improve learner motivation and persistence (Deterding et al., 2011). Tools like ClassDojo and Quizizz incorporate point systems, avatars, and badges to create reward-based learning environments that support self-determination and motivation among learners with ID (Burguillo, 2010). Studies show that gamified interventions can significantly improve cognitive task performance and encourage active participation in learning (Alsawaier, 2018; Hamari et al., 2014).

Functional skills are practical abilities necessary for daily living and social independence, such as managing routines, self-care, and navigating the community. Learners with ID often require structured and repetitive instruction in these domains. Visual schedules and task-sequencing applications such as Choiceworks, First Then Visual Schedule, and Time Timer are widely used to support learners with ID in managing daily routines. These tools provide step-by-step visual prompts that reduce anxiety, support transitions, and build time-awareness skills (Bryant et al., 2020). A study by Cihak et al. (2008) found that mobile visual scheduling applications improved independent task completion among students with ID by over 60%.

Social stories, developed originally by Carol Gray, are widely used in digital form to address behaviour, social norms, and emotional regulation (Gray, 2010). Applications like Social Story Creator & Library and Model Me Going Places offer customisable templates and videos that help learners with ID anticipate social scenarios and appropriate responses (Hagiwara & Myles, 1999). Video modelling – presenting desired behaviours through video examples – has also been proven effective in teaching hygiene, conversation, and classroom behaviour (Sigafoos et al., 2007).

Virtual Reality (VR) and AR offer immersive, safe environments where learners with ID can practice real-life skills such as street crossing, shopping, or using public transportation. Tools like Floreo and Virtually Better simulate scenarios that help generalise functional skills into real-world settings (Rojas-Barahona et al., 2021). Research has shown that VR interventions can improve task performance, reduce anxiety, and provide a safe space for repeated practice (Kandalaft et al., 2013).

Communication barriers are a common characteristic of ID, affecting expressive and receptive language skills. Digital technology has revolutionised how these challenges are addressed, particularly through AAC systems. AAC tools like Proloquo2Go, TouchChat, and GoTalk NOW provide symbol-based

communication support for non-verbal or minimally verbal learners. These applications offer customisable vocabulary, voice output, and user-friendly interfaces that promote independent communication (Lorah et al., 2018). AAC has been shown to improve social interaction, classroom participation, and behaviour regulation (Light & McNaughton, 2011).

Speech-generating devices (SGDs), such as Dynavox and Tobii, convert text or symbols into spoken output, empowering learners to express their needs and thoughts. Symbol-based systems using Picture Exchange Communication System or Widgit Symbols are also integrated into tablet applications and digital communication boards to support visual learners (Alzrayer et al., 2014). These interventions reduce frustration and enhance communicative competence (Beukelman & Mirenda, 2013).

Applications that incorporate multisensory instruction, combining visual, auditory, and tactile elements, enhance language development and comprehension. Examples include Montessori Crosswords and Endless Reader, which provide phonics-based learning using sound, touch, and imagery (Rose & Meyer, 2006). In addition, bilingual tools like Lingokids support language acquisition in multilingual contexts, enabling learners with ID from diverse linguistic backgrounds to develop stronger communication skills (Kormos & Smith, 2012).

The increasing inclusion of learners with ID in general and special education settings necessitates innovative approaches to address their diverse learning and functional needs. Technology has emerged as a transformative tool in facilitating instruction, engagement, communication, and daily living activities for this population (Alnahdi, 2020; Edyburn, 2020). By aligning digital interventions with IEP goals and integrating them into everyday classroom routines, educators and caregivers can significantly enhance learning outcomes and quality of life for learners with ID.

Technology integration in the classroom must be purposeful, inclusive, and adaptable to the learners' cognitive, sensory, and physical needs. Tools such as tablets, interactive whiteboards, and adaptive keyboards allow for differentiated instruction and provide alternative ways to access content (Dell et al., 2016). Interactive whiteboards, for instance, enable visual and tactile engagement with learning materials, which is essential for students who benefit from multisensory instruction (Lorah et al., 2022). Likewise, tablets offer portability and allow individualised access to applications that reinforce academic skills in areas such as reading, math, and communication (Sigafoos, 2007).

Educators can use educational applications designed to improve attention, sequencing, and cause-effect understanding – skills that are typically underdeveloped in learners with ID (Knight et al., 2019). In addition, platforms like Google Classroom and SeeSaw facilitate structured assignment delivery and enable learners to work at their own pace. Integrating such platforms into daily instruction promotes autonomy and helps foster digital literacy skills (Rose & Meyer, 2006). Furthermore, the UDL framework provides a practical guide for technology use in classrooms. It emphasises offering multiple means of representation, engagement, and expression, which digital tools are uniquely suited to provide (CAST, 2018). By incorporating audio-visual materials, speech-to-text applications, and interactive quizzes, teachers can make lessons more inclusive for learners with varying abilities and needs (Al-Azawei et al., 2016).

A critical consideration in integrating technology is ensuring alignment with each student's IEP. The IEP outlines specific, measurable goals tailored to the learner's unique strengths and challenges, including academic, behavioural, and functional targets (Yell et al., 2003). Technology tools should be chosen based on how effectively they can support the achievement of these goals.

For instance, if a learner has a goal to improve communication, AAC apps like Proloquo2Go or TouchChat HD may be embedded into the learner's daily schedule (O'Malley et al., 2014). Similarly, if a goal centres on improving time management or self-care, visual schedule apps such as Choiceworks can be used to support task completion and independence (Sigafoos et al., 2007). Data from technology tools can also feed directly into the progress monitoring component of the IEP. Applications that track academic performance, behaviour logs, or frequency of AAC usage offer quantifiable evidence of progress or lack thereof, allowing for timely instructional adjustments (Bouck & Long, 2020). The built-in analytics in platforms such as ClassDojo and Edmodo make them valuable tools not only for learning but also for documentation and evaluation of IEP outcomes (King-Sears & Evmenova, 2007).

The effective use of technology for learners with ID requires collaboration among all stakeholders, including educators, therapists, and caregivers. Each party brings unique expertise that informs us how, when, and why certain technologies should be implemented. Speech and occupational therapists can help select devices and applications that align with therapeutic goals, while caregivers can reinforce the use of these tools at home (Lorah et al., 2022). Regular team meetings and communication channels, such as shared

digital folders or communication applications (e.g. Remind, ClassTag), facilitate consistent information sharing. These tools allow team members to monitor usage patterns, evaluate effectiveness, and troubleshoot problems as they arise (Sutherland et al., 2018). Moreover, training sessions for caregivers and paraprofessionals are essential to ensure fidelity in technology use across environments (Dessemontet et al., 2012).

Parental involvement is particularly critical in reinforcing the use of educational and assistive technology at home. Studies have shown that when parents are trained and actively involved, children with ID demonstrate more significant gains in communication and academic skills (Ramdoss et al., 2012). In addition, providing culturally responsive and linguistically appropriate resources ensures equity and accessibility for diverse family backgrounds (Wehmeyer & Shogren, 2017).

Continuous assessment and feedback are vital to ensure the effectiveness of technology interventions. Technology allows for real-time tracking of student progress, automated performance summaries, and detailed analytics that inform instruction (Edyburn, 2020). For instance, learning management systems like Moodle and Canvas enable teachers to monitor log-in times, time-on-task, and assignment completion rates, which provide insights into student engagement and learning patterns (Dell et al., 2016).

Data visualisation tools can also help identify trends over time. Applications like ABC Data Pro or Behaviour Tracker Pro allow for charting behaviour data, while academic platforms such as IXL and Khan Academy offer individual learner profiles with strengths and areas for growth (Sutherland et al., 2018). This information can be shared with the IEP team during meetings and used to adjust goals or strategies as needed.

Moreover, integrating formative assessments within digital learning environments ensures immediate feedback and helps maintain student motivation (Melby-Lervåg & Hulme, 2013). Teachers can design interactive quizzes using tools like Kahoot! or Quizizz to reinforce previously taught content while simultaneously collecting assessment data. However, technology should not be viewed as a one-size-fits-all solution. Regular evaluation of its appropriateness, usability, and effectiveness is necessary. Educators must consider whether a tool genuinely supports learning or merely adds novelty. User satisfaction surveys, observation checklists, and structured interviews with students and families can complement quantitative data in evaluating tool effectiveness (Knight et al., 2019).

The increasing integration of digital technologies into special education has unlocked new possibilities for learners with ID. However, as the adoption

of these technologies expands, critical challenges, limitations, and ethical concerns must be addressed to ensure equitable, effective, and responsible usage. These include issues surrounding the digital divide, technological dependency, overstimulation, data privacy, consent, and the imperative for ongoing teacher training and support systems.

One of the foremost challenges in leveraging digital tools for learners with ID is the digital divide, particularly in underserved communities. Access to appropriate technology, high-speed internet, and technical support remains limited in many low-income and rural settings (Alnahdi, 2020). This disparity restricts the opportunities of learners with ID to benefit from technology-driven educational interventions, exacerbating pre-existing educational inequities (Dell et al., 2016).

In many parts of the world, particularly in developing countries, schools lack the infrastructure necessary to implement digital learning effectively. Even where devices like tablets or interactive whiteboards are available, inconsistent electricity supply and inadequate internet connectivity impede regular usage (Dessemontet et al., 2012). Moreover, households of learners with ID may lack the financial means to afford personal devices or data subscriptions, thereby limiting home-based learning (Wehmeyer & Shogren, 2017). Another aspect of the digital divide pertains to accessibility features. While many digital platforms claim to be inclusive, they may not be optimised for learners with varying levels of cognitive or functional impairments (Ramdoss et al., 2012). In such cases, learners with severe ID may find it difficult to engage with technology independently, thereby requiring constant adult assistance.

While digital tools can enhance cognitive engagement and motivation, over-reliance may foster technological dependency among learners with ID. This dependence could impede the development of offline social skills and practical life experiences (Melby-Lervåg & Hulme, 2013). Learners may become conditioned to respond only to interactive, screen-based prompts, thus reducing intrinsic motivation and self-regulation. Moreover, excessive screen time raises concerns about overstimulation. Many educational applications employ bright visuals, rapid feedback, and gamified rewards that, if not moderated, can overwhelm or dysregulate learners with sensory processing issues (Knight et al., 2019).

Research by Sutherland et al. (2018) found that learners with ID are particularly vulnerable to attention fragmentation and sensory overload when exposed to non-stop digital stimuli. Parents and educators may also inadvertently reinforce this dependency by using digital tools as behavioural

reinforcers, potentially sidelining essential social interactions and hands-on activities that are crucial for holistic development (Lorah et al., 2018). Therefore, balanced use of integrating digital resources with traditional learning and physical activities is vital.

The integration of technology into education introduces significant ethical concerns, particularly around data privacy and informed consent. Learners with ID are often minors or individuals who may not fully comprehend the implications of data sharing. This necessitates robust protections to ensure their personal information, learning data, and behavioural records are handled with confidentiality and integrity (Yell & Katsiyannis, 2003).

Educational technologies often collect vast amounts of user data to personalise learning experiences or generate progress analytics. However, inadequate regulation and a lack of transparency about data usage can lead to misuse or breaches (O'Malley et al., 2014). Schools and institutions must therefore ensure compliance with data protection regulations like the General Data Protection Regulation or the Family Educational Rights and Privacy Act, particularly when partnering with private tech providers.

Consent processes must also be adapted for individuals with ID. While legal guardians typically provide consent, ethical practice mandates that learners be included in the decision-making process to the extent possible, using accessible formats and communication aids (Rojas-Barahona et al., 2022). This participatory approach upholds the dignity and autonomy of the learner and aligns with the principles of inclusive education.

Another significant challenge is the lack of teacher preparedness to effectively integrate digital technology into instruction. Despite the availability of high-quality tools, their success largely depends on how well teachers can use them to meet the IEP goals of learners with ID (Dell et al., 2016). Studies have shown that without adequate training, teachers may either underuse or misuse digital tools, leading to minimal educational benefit (Alnahdi, 2020).

Professional development must not be limited to initial training but should include ongoing support, peer mentoring, and access to troubleshooting resources. According to Wehmeyer and Shogren (2017), sustained teacher training programmes that focus on both technical and pedagogical aspects significantly improve outcomes for students with disabilities. In addition, teachers must be trained to evaluate the efficacy of digital tools through regular monitoring and data analysis.

Collaborative planning among educators, therapists, and caregivers is also essential to ensure consistency in using digital tools across environments.

This collaboration allows for better alignment of school-based interventions with home routines and therapy goals (Knight et al., 2019). However, logistical issues, time constraints, and lack of communication channels often hinder such collaboration. Furthermore, the lack of culturally and linguistically responsive digital content presents a barrier in multilingual or multicultural educational settings. Many platforms are designed with monolingual, Western learners in mind, limiting their relevance and effectiveness for diverse populations (Sigafoos et al., 2007).

CONCLUSION

The integration of digital technology into education for learners with ID offers promising avenues for enhancing learning outcomes and engagement. However, it is essential to acknowledge and address the challenges that accompany this shift. Issues such as the digital divide highlight the disparities in access to technology and the internet, particularly in low-income and rural communities, which can hinder the benefits that these tools provide. Ensuring equitable access requires a concerted effort from educators, policymakers, and communities to bridge these gaps and provide necessary resources for all learners.

Moreover, the risk of technological dependency and overstimulation must be carefully managed. While digital tools can boost motivation and engagement, reliance on them should not replace the development of essential social skills and real-world experiences. Educators play a critical role in balancing the use of technology with traditional learning methods, ensuring that students not only thrive in digital environments but also build resilience and independence.

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