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Ethical Use of Assistive Technology for Adolescents with Cognitive Disabilities: A Narrative Review

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Abstract

Adolescents with cognitive disabilities face unique developmental, social, and functional challenges that complicate their access to autonomy, education, and participation. Assistive technology (AT) has emerged as a powerful tool to support communication, learning, and daily functioning in this population. However, its deployment introduces complex ethical concerns. This narrative review critically examines the ethical considerations associated with AT use for adolescents with cognitive disabilities, focusing on five key themes: consent and decision-making, autonomy and independence, privacy and data protection, accessibility and usability, and equity in access and implementation. This review screened 50 documents, of which 20 were retained for full inclusion based on their relevance to ethical concerns in the use of assistive technology Key Themes in the Literature or adolescents with cognitive disabilities. Findings highlight the need for adolescent-centered approaches that respect evolving capacities, cultural contexts, and individual agency. Ethical AT implementation must move beyond procedural compliance to foster inclusive, responsive, and participatory practices. This review contributes a structured ethical framework specific to the use of assistive technology (AT) among adolescents with cognitive disabilities, an area that remains underexplored in current literature. While previous studies have discussed general ethical concerns related to AT or disability, few have integrated adolescent developmental theory, rights-based ethics, and practical considerations into a single, coherent review. By organizing ethical issues around five core themes consent and decision-making, autonomy, privacy, accessibility, and equity, this paper advances a more narrative review and adolescent-specific ethical lens for understanding AT implementation. It emphasizes adolescence as a unique developmental stage marked by emerging autonomy, evolving identity, and shifting capacities, all of which are critical to ethical decision-making but are often overlooked in existing research. The review concludes with recommendations for policy development, participatory research, and capacity-building among educators, developers, and caregivers. It calls for ethical reflection to be embedded not only in the design and deployment of AT, but also in training programs and institutional practices. As AT continues to evolve, ethical practices must evolve in tandem, ensuring that technological tools empower rather than marginalize adolescents with cognitive disabilities and that implementation is both developmentally appropriate and socially acceptable.

Keywords: assistive technology; adolescents; cognitive disabilities; ethical considerations; consent; autonomy; privacy; accessibility; equity

1. Introduction

Adolescence is a developmental phase characterized by significant psychological, emotional, and physiological changes [1]. This stage is pivotal for forming personal identity, fostering autonomy, and establishing meaningful social relationships. Adolescents with cognitive disabilities also exhibit higher rates of psychological distress, which may further compound their difficulties in navigating social contexts [2]. Adolescents often seek independence and begin making decisions that shape their futures. However, those with cognitive disabilities may encounter substantial barriers in these areas due to impairments in memory, attention, executive functioning, and social cognition. Ethical evaluation of assistive technology requires attention to not only access and functionality, but also broader concerns of justice and dignity [3]. Conditions under this umbrella include intellectual disabilities, learning disorders, traumatic brain injuries, and neurodevelopmental disorders such as autism spectrum disorder. Adolescents with intellectual disabilities often face environments that are not conducive to their health and development, especially in institutional care settings where their individual needs may be met [4]. This review adopts a narrative approach, aiming to explore and discuss key ethical considerations rather than systematically evaluate the literature [5]. Relational ethics emphasized This review fills that gap by thematically synthesizing ethical concerns from 20 selected documents and framing them through multiple ethical lenses, including principles-based, rights-based, relational, and virtue ethics. The goal is to inform not only scholarly debate, but also practical policy and implementation strategies grounded in ethical sensitivity and adolescent agency.

Assistive technology (AT) encompasses a range of tools and devices aimed at enhancing functional capabilities for individuals with disabilities. Rather than framing AT merely as a technical fix, scholars argue for a capabilities-oriented perspective that links AT to broader questions of human development, autonomy, and dignity [6]. These technologies have become increasingly prominent in the support of adolescents with cognitive disabilities. From speech-generating devices and wearable tech to AI-driven learning apps and organizational tools, AT has redefined the landscape of educational, social, and daily living support. Used appropriately, AT can bridge gaps in communication, participation, and independence, contributing meaningfully to the quality of life. Tools such as indoor navigation systems must be designed with adaptive user interfaces to accommodate varying cognitive capabilities [3].

Nonetheless, the integration of AT in the lives of cognitively adolescents with disabilities introduces a host of ethical concerns. These include the nuances of obtaining meaningful consent, balancing autonomy with protection, maintaining data privacy, ensuring accessibility, and addressing equity in access. Moreover, in low-resource contexts, adolescents with disabilities are frequently excluded from policymaking processes and data collection, undermining efforts toward inclusive technological planning [7]. This paper undertakes a narrative review of ethical considerations associated with AT usage in this population, aiming to inform ethical practice, enhance policymaking, and ensure that technological advancements align with the evolving capacities and rights of adolescents.

2. Materials and Methods

A desktop-based literature search was conducted using a narrative approach across PubMed, Scopus, Web of Science, and Google Scholar. Approximately 140 studies were purposively selected for their relevance to ethical issues in assistive technology for adolescents with cognitive disabilities. While the overall number reflects results across all four databases, selection based on thematic relevance or database-specific quotas were applied, as this review follows a narrative framework. No formal inclusion/exclusion criteria or quality appraisal tools were applied, as is consistent with narrative review methodology. To guide this narrative review, we selected a purposive sample of thematically relevant literature identified through searches across four academic databases. The studies chosen provided diverse and illustrative perspectives on key ethical issues surrounding assistive technology use in adolescents with cognitive disabilities. Special attention was given to low- and middle-income country (LMIC) contexts due to the systemic infrastructural, cultural, and funding challenges that shape AT implementation for adolescents with disabilities [6]. Keywords used included "assistive technology," "adolescents," "cognitive disabilities," "ethics," "consent," "autonomy," "privacy," "accessibility," and "equity."

A non-systematic narrative approach was used to identify relevant literature, guided by key themes in ethics and assistive technology. The Relevant Ethical Topics Identified for this review encompassed English-language publications that focused specifically on adolescents aged 10–19 years with cognitive disabilities, where AT was used or discussed and ethical dimensions were explicitly or implicitly addressed. Studies were retained if they examined issues such as consent, autonomy, privacy, equity, or usability in relation to AT. Both empirical and conceptual studies were considered, including randomized trials, observational studies, systematic reviews, theoretical discussions, and policy briefs. Publications from a variety of settings clinical, educational, and domestic were included to capture the multidimensional nature of ethical concerns. Exclusion criteria involved studies focusing exclusively on children under 10 or adults over 19, as well as those that lacked discussion on ethical considerations. Studies that focused purely on technical evaluations or usability testing without reference to ethical implications were also excluded.

Thematic analysis was employed to extract and synthesize ethical concerns. Ethical frameworks referenced in this review include principles-based ethics (autonomy, beneficence, non-maleficence, justice), rights-based perspectives, utilitarian reasoning, relational ethics, and virtue ethics.

The narrative review design was chosen for its ability to accommodate a broad range of literature types and ethical arguments. Unlike systematic reviews, which rely on strictly defined methodological Illustrative Studies Reviewed, narrative reviews are well-suited to exploring complex, multidisciplinary topics that intersect philosophical, technological, clinical, and educational domains. In this case, the diversity of sources, ranging from empirical studies and conceptual essays to ethical guidelines and grey literature, necessitated a flexible approach that allowed the integration of various perspectives and theoretical contributions.

The desktop research process was iterative and reflexive. Initial searches were broad, using primary keywords in combination with Boolean operators (AND/OR/NOT) to capture intersecting topics. For example, search strings such as "assistive technology AND adolescents AND consent" or "autonomy AND cognitive disabilities AND ethical considerations" were employed. The initial pool of results was filtered by title and abstract relevance, followed by full-text transmission. Publications were grouped according to the primary ethical focus, which informed the thematic categories eventually presented in the Results section.

To inform this narrative review, a purposive sample of relevant literature was selected across four databases (PubMed, Scopus, Web of Science, and Google Scholar). Rather than exhaustively reviewing all available records, we identified a subset of studies that were thematically rich and relevant to the ethical considerations of assistive technology use in adolescents with cognitive disabilities.

The frameworks employed for ethical interpretation were selected based on their prevalence in literature and their applicability to adolescent development and disability contexts. This study draws from Beauchamp and Childress's principles of biomedical ethics, Nussbaum's capabilities approach [8], and relational ethics theory [9] to explore the nuanced ethical implications of assistive technologies for adolescents Principles-based ethics offered a foundational lens for evaluating obligations and moral duties [10]. The rights-based approach was useful in highlighting the entitlement of adolescents with disabilities to equal participation, informed choice, and personal dignity. Utilitarian reasoning helped examine trade-offs in cases where collective benefits might come at the expense of individual preferences.For example, when introducing a school-wide AI-based monitoring system designed to enhance classroom safety, a principles-based approach would require educators to assess their duty to respect the adolescent's autonomy and avoid harm. A rights-based perspective would emphasize that adolescents with cognitive disabilities must have equal say in whether and how the system affects them, including the right to opt out. Meanwhile, a utilitarian evaluation might weigh the system's overall safety benefits for the school against the discomfort or privacy loss experienced by individual students, prompting a careful analysis of whether the benefit to the majority justifies the ethical cost to a vulnerable minority. Relational ethics emphasized interdependence and the contextual nature of ethical decision-making [11], particularly relevant in caregiving and educational settings. Lastly, virtue ethics added a character-driven lens, prompting reflection on the responsibilities of caregivers, educators, and technology developers in fostering ethical environments.

Throughout this review, the research process acknowledged the author's own perspectives and limitations inherent in relying solely on existing literature (i.e., desktop-based research). While the range of sources reviewed was broad and insightful, no primary data (e.g., interviews, surveys, or direct observations) were collected. As a result, the findings are interpretative rather than generalizable, meaning they offer conceptual insights and ethical reflections but may not directly predict how AT is used or experienced in every context. Relational ethics emphasizes that ethical decision-making is not isolated but shaped through relationships, power dynamics, and social context. This is especially relevant in caregiving and educational settings, where adolescents with cognitive disabilities depend on others for support, and where decisions often involve families, teachers, and health professionals. Virtue ethics, on the other hand, focuses on the character and moral integrity of the people involved. It asks whether caregivers, educators, or technology developers are acting with empathy, patience, courage, and a sense of justice. While the breadth of the literature provided a rich foundation for analysis, the absence of primary empirical data means that the conclusions are interpretative rather than generalizable. However, this methodology is consistent with the aims of a narrative ethical review, which seeks to illuminate conceptual gaps, highlight areas of consensus or debate, and inform the development of more grounded ethical practices.

To maintain rigor and transparency, all included articles were cataloged in a spreadsheet noting the publication year, authorship, journal/source, ethical focus, population demographics, and relevance to one or more of the five core ethical themes.Studies aligning with established definitions of adolescent cognitive thresholds and intervention responsiveness were retained [12]. This added layer of verification enhanced the credibility of the thematic synthesis.

The decision to focus on adolescents as a distinct age group (10–19 years) aligns with definitions by the World Health Organization and United Nations and acknowledges the developmental uniqueness of this period. Adolescents occupy a complex intersection between dependency and emerging independence, which deeply influences the ethical implications of AT deployment. Their evolving cognitive capacities, legal status, and social dynamics demand careful ethical navigation that is sensitive to both their vulnerabilities and their rights.

Finally, the narrative synthesis in this review serves not only to categorize ethical concerns but to foreground the human implications of technological interventions. The method aimed to uphold a critical stance that moves beyond technological optimism or skepticism and instead promotes ethically reflective practice that places adolescents with cognitive disabilities at the center of decision-making processes.

3. Results

The five key ethical themes consent and decision-making, autonomy and independence, privacy and data protection, accessibility and usability, and equity in access and implementation were identified through a careful and interpretive reading of the 20 retained sources. As the literature was reviewed, patterns began to emerge in how ethical issues were discussed and prioritised across different contexts. These recurring concerns were grouped based on their relevance to core ethical principles and their practical implications for adolescents with cognitive disabilities. For instance, several articles highlighted the complexities of gaining informed consent and supporting adolescent voice, which informed the theme of consent and decision-making. Others emphasized challenges with access, design relevance, and socio-economic disparities, leading to the theme of equity in access and implementation. This thematic grouping emerged organically through repeated engagement with the selected literature and was guided by existing ethical frameworks in adolescent and disability care. While not a formal coding process, this thematic documentation offered a structured way to synthesize the key ethical dimensions found in the literature.

3.1.

Consent and Decision-Making One of the most critical ethical challenges relates to the question of consent. Adolescents are in a transitional cognitive and legal state, many are beginning to participate in decisions about their healthcare and education but may still be under parental or institutional authority. Cognitive disabilities further complicate the capacity to understand, weigh, and communicate informed consent.

In practice, consent in AT use is frequently mediated by caregivers, educators, or clinicians, particularly in school or therapeutic contexts. While proxy consent may be necessary in some cases, ethical practice demands that adolescents be actively involved in the decision-making process wherever possible. This aligns with broader research suggesting that caregivers often misjudge adolescents decision-making capacities, reinforcing protective but disempowering dynamics [13]. Promising practices include involving adolescents with disabilities in age-appropriate decision-making structures and research, building adolescents' awareness of their rights, and enhancing their self-confidence to voice their needs and advocate for change [14].Supported decision-making is gaining traction as a rights-affirming model that recognizes the importance of agency and capacity-building. Many parents do not adequately recognize the capacities of their adolescents with disabilities and their need to express their views, build self-confidence and start making independent choices and decisions. This approach includes tools such as visual aids, interactive consent forms, multimedia explanations, and repeated opportunities to ask questions.

However, tensions emerge when the adolescent's preferences are at odds with those of adults or institutions. For example, an adolescent might resist the use of a wearable device intended to support behavior regulation, perceiving it as intrusive or stigmatizing. In such cases, ethical deliberation must consider the adolescent's developmental stage, cognitive profile, and the potential long-term impact of overriding their preferences. There is also the risk of tokenistic involvement, where adolescents are superficially included in discussions without meaningful influence on the outcomes. Genuine consent requires not only comprehension but also the freedom to dissent without punitive consequences. Research shows that stress, disrupted routines, and low familiarity with information systems can severely hinder decision-making in adolescents with cognitive disabilities, especially in emergency contexts where understanding one's surroundings is vital for making autonomous choices [2].[7] (2024) evaluated cognitive interventions in adolescents with psychological distress, highlighting challenges in informed consent due to cognitive load and stress factors. Similarly, [4] (2024) noted that institutional care often limits adolescent voice and autonomy in health-related decisions.

3.2.

Autonomy and Independence Autonomy is widely recognized as a central ethical value in adolescent development, and AT can serve as a powerful tool for promoting autonomy among those with cognitive disabilities. Planning difficulties are particularly pronounced among adolescents with intellectual disabilities, who often require structured support despite developing life experience [7]. By enhancing communication, navigation, time management, and learning capabilities, AT can enable adolescents to participate more fully in academic, social, and domestic activities. For instance, digital communication boards empower non-verbal adolescents to express preferences and make requests, reinforcing their sense of agency. The study by [9] (2022) on behavioral interventions paired with assistive tools revealed significant gains in self-regulation among adolescents with conduct disorder, showing how AT can scaffold autonomy. [18] (2022) linked autonomy to justice and personal dignity in the ethical application of technology.

Nevertheless, the use of AT can also undermine autonomy if implemented without regard to the adolescent's values and goals. In schools, AT is sometimes used to enforce conformity to behavioral norms, rather than to support individual growth. Moreover, adolescents may become overly dependent on technology if their use is not balanced with opportunities to develop human-based competencies. An overemphasis on technological solutions can displace human interaction, especially when efficiency and cost-effectiveness become institutional priorities. AI-driven assistive

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systems, especially in healthcare and education, often raise concerns about algorithmic bias, lack of transparency, and limited user control [12].

Relational autonomy provides a helpful counterpoint by emphasizing that autonomy is shaped through relationships, not isolated decision-making. “Adolescents with disabilities are perceived to be dependent, passive recipients of support rather than citizens with rights” [5]. Adolescents achieve autonomy not by acting independently of others, but by engaging in trusting, supportive relationships that allow them to explore, make mistakes, and learn. This model urges adults to consider how they can scaffold rather than substitute autonomy. In practice, this could involve setting joint goals with adolescents, reflecting on the use of AT together, and adjusting strategies based on the adolescent’s feedback. Everyday functioning, including autonomy in unfamiliar environments like shopping malls or hospitals, is enhanced when assistive technologies include sensory navigation features adapted for cognitive needs. These solutions can mitigate the dependency on human assistance and reinforce self-directed mobility [2].

3.3.

Privacy and Data Protection The proliferation of smart technologies in assistive contexts has brought privacy and data protection to the forefront of ethical concerns. Many AT devices collect personal data, including geolocation, usage patterns, voice recordings, and biometric information. This data are often stored in cloud-based systems managed by private companies, raising questions about consent, ownership, access, and long-term storage. “ICTs can pose certain risks, especially if adolescents with disabilities are not provided with training to understand how best to use them without putting themselves in danger” [5]. Adolescents with cognitive disabilities may have limited understanding of these implications, making them particularly vulnerable to privacy violations. The adoption of AI-based assistive tools has introduced ethical concerns around surveillance, with adolescents especially vulnerable to unintended data misuse [19].

Parents and schools may view data collection as beneficial for monitoring progress, ensuring safety, or customizing support. However, these benefits must be weighed against the potential costs to the adolescent’s dignity, trust, and sense of security. Surveillance can inadvertently communicate a lack of trust and erode the adolescent’s developing sense of privacy and self-management. Furthermore, the permanence of digital records raises concerns about future repercussions, including stigma, discrimination, or unintended secondary use of data. [19] investigated AI-supported interventions, noting that adolescents were particularly vulnerable to data surveillance, often without full understanding of implications. Technologies like wearable trackers raised significant questions about consent and long-term data use.

Ethical AT implementation requires robust data governance policies and a commitment to transparency. Adolescents and their families must be informed, in accessible ways, about what data are being collected, who has access, and how long data will be retained. Privacy-by-design principles should guide developers in creating tools that minimize unnecessary data collection and allow users to control their own data. Involving adolescents in these discussions helps them build digital literacy and ethical awareness, which are critical for life in a data-saturated world.

3.4.

Accessibility and Usability The ethical imperative of accessibility goes beyond making AT available; it includes ensuring that technologies are usable, culturally relevant, and responsive to diverse cognitive profiles. Adolescents with cognitive disabilities are not a homogenous group, and what works well for one user may be ineffective or even harmful for another. Tools must be personalized to accommodate language abilities, processing speeds, executive function challenges, and other unique characteristics. [15] (2020) assessed QR-based indoor navigation for intellectually disabled youth, identifying operational burdens that conflicted with user needs. Their findings underline the importance of co-design and stress-free UX adaptation.

Moreover, adolescents care deeply about how they are perceived by their peers. Devices that are bulky, conspicuous, or associated with disability stigma may be rejected outright, regardless of their utility. Usability, in this context, includes social acceptability and user dignity. Designers must therefore consider not only functional performance but also aesthetics, discretion, and adaptability to different environments. “Accessibility also refers to access to appropriate languages and devices, such as Braille and sign language or speech-generating devices, and alternative scripts and modes, such as audio and large-print materials” [7]. “In Uganda, only 11% of students requiring Braille, audio-recorded or enlarged print received it” [7].

Participatory design processes, which involve adolescents in every stage of development, have shown promise in enhancing both usability and ethical fit. However, design remains a barrier. For example, QR code-based indoor navigation systems may seem affordable, but they place cognitive and operational burdens on users with intellectual disabilities, making them inappropriate in contexts requiring quick or stress-free interaction, such as emergencies [15].These approaches allow users to identify what matters most to them, co-create solutions, and test devices in real-life settings. This not only results in better tools but also affirms the adolescent’s role as a co-author of their technological future. Ethical usability also requires responsive feedback mechanisms, enabling adolescents to report discomfort, frustration, or unintended consequences. Healthcare professionals and educators play a crucial role in cultivating supportive, respectful environments where adolescents can thrive with AT [4].

3.5.

Equity in Access and Implementation Equity remains one of the most pressing ethical challenges in AT deployment. Economic disparities, systemic discrimination, and uneven institutional support create significant gaps in who gets access to what technologies. In some cases, AT may be available in urban schools but absent in rural or underfunded settings. In others, private insurance may cover certain tools while public systems lag behind. Tactile apps and voice-guided tools co-developed with visually impaired youth illustrate how the Thematic Focus of the Review in design improves both functionality and uptake [11]. These inequities perpetuate cycles of exclusion and disadvantage for adolescents who are already marginalized.

Equity also involves recognition of intersectionality. Adolescents with cognitive disabilities may face compounded disadvantages based on race, gender, socioeconomic status, or language background. “In Palestine, over 16% of children and adolescents with physical impairments do not have a wheelchair and over a third of those who need hearing aids do not have them” [5].Ethical AT practice must therefore include deliberate efforts to reach underserved populations, address language and literacy barriers, and ensure that technologies are adaptable to different cultural contexts.

Reports from [16] (2023) and [17] (2022) emphasized inequitable AT provision, particularly in LMICs. Only 11% of Ugandan students needing Braille or audio materials had access, reflecting systemic implementation gaps. Public investment and policy reforms are essential to close these gaps. This includes funding for device procurement, internet access, training programs, and ongoing support services. Ethical implementation also involves building capacity within communities empowering schools, families, and local agencies to advocate for and sustain AT usage. Some interventions, such as sensory-based indoor navigation, are being explored to reduce dependence on caregivers and improve mobility confidence [18]. Without these structural supports, even the most advanced technologies risk becoming tools of exclusion rather than empowerment. The “difference model” of intellectual disability also suggests that individuals with cognitive impairments may need assistive approaches tailored to qualitatively different planning and cognitive processing styles, rather than those simply matched to their mental age [4].

Each of the five ethical themes was developed through thematic reading of the retained studies. Specifically, 13 of the 19 reviewed sources contributed to discussions around consent and decision-making; 11 studies informed insights into autonomy and independence; 10 sources addressed privacy and data protection; 12 engaged with accessibility and usability concerns; and 14 provided perspectives relevant to equity in access and implementation. Several studies overlapped across multiple themes, reflecting the complex and interrelated nature of ethical considerations in assistive technology for adolescents with cognitive disabilities. Issues were noted across the full texts of the 20 included studies and organized into recurring categories.

4. Discussion

This review highlights the ethical complexity of implementing AT for adolescents with cognitive disabilities. Consent, autonomy, privacy, accessibility, and equity are not isolated concerns; they intersect in ways that demand comprehensive, context-sensitive solutions. The reviewed studies offer critical insights into the ethical implementation of AT but vary in depth and empirical grounding. For instance, [3] (and [20] provide conceptual analyses with strong ethical scaffolding but lack real-world user data. Meanwhile, [21] offers practical testing of usability but is limited by small, controlled sample sizes. A notable strength across many reviewed documents is their emphasis on rights and dignity frameworks, aligning with global disability discourse (e.g., [22]). However, several studies, particularly policy briefs, remain descriptive rather than analytical, limiting their transferability to diverse cultural contexts.

Policymakers must prioritize participatory design and culturally relevant implementation. For example, the studies underscore the risks of data misuse [23].and how these may deter adolescents from engaging with otherwise helpful technologies. Practitioners need training not just in functionality, but in ethical reflection, as suggested by [24].The recurring theme of caregiver adolescent power dynamics [25].implies a need for relational ethics training in institutional setting.

Ethical AT use must begin with a commitment to respecting adolescents as developing moral agents with evolving capacities [26]. Recognizing the adolescent's voice in ethical deliberation involves moving beyond paternalistic models of care and toward participatory, empowering practices. The value of co-design and co-decision making cannot be overstated. When adolescents are actively engaged in decisions about their assistive tools, the likelihood of adoption, satisfaction, and long-term success increases. Approaches such as cognitive behavioral therapy, when paired with AT interventions, offer layered support for adolescents with conduct or emotional regulation challenges [27].

Ethical frameworks such as relational ethics [28] and rights-based approaches offer robust scaffolds for action. Relational ethics emphasizes the contextual nature of moral reasoning, foregrounding the adolescent's relationships with caregivers, teachers, peers, and clinicians. It encourages shared responsibilities and acknowledges power imbalances, particularly when adolescents rely on others to access or operate AT. In contrast, rights-based approaches stress the importance of autonomy, dignity, and non-discrimination. These frameworks support the assertion that all adolescents regardless of ability are entitled to technologies that enhance their quality of life and facilitate their inclusion in society.

The intersectionality of ethical issues often leads to complex dilemmas. Consider a teenager with an intellectual disability using a wearable location tracker to navigate school independently. While the tool may enhance safety and autonomy, it also raises concerns about surveillance and privacy. Who controls the data? Is the adolescent aware of the data collection and its implications? If parents or staff can access location logs, does that erode trust and hinder the adolescent's sense of self-direction? These are not hypothetical questions, but real tensions faced in everyday practice. Addressing behavioral challenges like conducting disorder through combined psychobehavioral approaches has been effective and provides parallels for designing AT that integrates social skill development [29].

The discussion must also recognize that ethical dilemmas are rarely resolved by applying a single principle. For instance, maximizing autonomy might inadvertently reduce protection, while prioritizing beneficence might limit informed consent. These trade-offs are particularly salient in institutional contexts like schools or hospitals, where AT implementation is often standardized.

Ethical use of AT in such settings requires flexible protocols that can be tailored to individual needs, preferences, and capacities.

An additional layer of complexity arises from cultural contexts. Norms regarding adolescence, disability, and technology vary significantly across cultures, affecting perceptions of what is appropriate or ethical. In some communities, parental authority may override adolescent preferences, or disability may carry stigma that influences the acceptance and visibility of AT. These sociocultural variables must be considered when crafting ethical guidelines or implementing AT interventions. A universal ethical framework must allow for local adaptation while maintaining core commitments to dignity, respect, and justice.

The speed of technological innovation outpaces the development of ethical guidelines and legal protections [29]. Emerging technologies such as artificial intelligence, augmented reality, and brain-computer interfaces promise new possibilities but introduce novel risks. AI-based learning tools, for example, can provide personalized educational support but also gather extensive behavioral data, often with minimal transparency. Similarly, smart assistants and IoT-enabled devices can increase independence but also expose users to potential data breaches or manipulation.

Policymakers, developers, and clinicians must collaborate to create dynamic, responsive ethical frameworks. These frameworks should evolve alongside technological developments and be grounded in ethical reflection, empirical research, and participatory input. Importantly, adolescents with cognitive disabilities should be included as stakeholders in the design and review of these frameworks. Inclusive research, policy codesign, and targeted investments in low-resource systems are essential for moving toward justice-centred AT frameworks [30]. Their insights offer critical perspectives that are often overlooked in traditional ethical deliberations. For instance, evidence shows that adolescents with intellectual disabilities often struggle to apply life experience to everyday planning tasks, suggesting that AT design should not assume prior experiential knowledge as a foundation for interface usability [4].

Ethical guidance must also address implementation practices. Simply providing access to AT does not guarantee ethical use. Educators and caregivers require training to understand not only the functionality of AT but also its ethical implications. They should be equipped to facilitate adolescent agencies, respect privacy boundaries, and identify potential misuse or over-reliance on technology. Ethical deployment involves creating environments where AT complements human support rather than replacing it.

This discussion also calls for a reorientation in research agendas. Much of the existing literature focuses on the efficacy or usability of AT, with less attention paid to ethical processes and outcomes. Future studies should explore how adolescents perceive ethical trade-offs, how consent is navigated in real-world settings, and how AT influence's identity, agency, and relationships. Participatory research methods, such as interviews, focus groups, and design workshops with adolescents and their caregivers, can generate context-rich data that inform more responsive ethical standards. The findings of this narrative review underscore that ethical considerations surrounding assistive technology (AT) cannot be viewed in isolation from the broader systems within which adolescents with cognitive disabilities live and learn. Practical implications must therefore address not just individual decisions about device use, but also the structural determinants that shape AT access, adoption, and impact.

One key implication is the urgent need to align funding mechanisms and procurement systems with ethical imperatives. Studies show that adolescents in low-resource settings are disproportionately excluded from AT innovations due to fragmented or underfunded health and education systems. Advocacy is needed to secure inclusive budgeting, equitable distribution of AT, and the integration of ethical safeguards in public tenders and vendor contracts.

Policy frameworks must also reflect the ethical responsibility of institutions to recognize adolescents with cognitive disabilities as rights-holders, not passive recipients of care. This includes embedding ethical training into teacher and clinician education, mandating adolescent participation in AT design and evaluation, and developing national policies that prioritize culturally responsive and age-appropriate technologies.

Moreover, the review highlights that cognitive-based interventions such as those used to treat psychological distress are significantly enhanced when supported by AT. For example, digital tools that reinforce emotional regulation or facilitate peer communication can amplify the benefits of therapy. This reinforces the ethical obligation for clinicians and educators to integrate AT into psychosocial support plans, ensuring that adolescents not only receive effective interventions but do so in a manner that respects their autonomy and enhances their long-term functioning. Ultimately, ethical AT implementation demands cross-sector collaboration, long-term investment, and structural reforms that view adolescents with cognitive disabilities as active participants in shaping inclusive, supportive, and dignified futures.

In conclusion, navigating the ethical landscape of AT for adolescents with cognitive disabilities demands an integrated, multidimensional approach. It is not sufficient to ask whether a particular technology is effective or even accessible, we must also ask who benefits, who decides, and under what conditions. Ethical AT use means empowering adolescents, safeguarding their rights, respecting their preferences, and ensuring that the technologies designed to support them do not inadvertently disempower or isolate them. As AT continues to evolve, our ethical thinking must evolve with it rooted in compassion, inclusivity, and an unwavering commitment to adolescent well-being.

5. Limitations and Future Research Perspectives

This narrative review offers an ethical synthesis of assistive technology (AT) use among adolescents with cognitive disabilities; however, several limitations must be acknowledged. First, the study relies solely on secondary data obtained through desktop-based literature searches. While this approach enables broad thematic coverage, it does not allow for primary data collection or validation through direct stakeholder engagement. As a result, the findings are interpretive rather than empirically generalizable.

Second, while an effort was made to include diverse geographic and socioeconomic contexts, the literature remains disproportionately skewed toward high-income countries. This creates a potential gap in understanding how ethical challenges manifest in low- and middle-income contexts, where infrastructural and policy barriers may be significantly different.

Third, the review synthesizes findings across multiple disciplines education, healthcare, technology design, and ethics, which, while valuable for breadth, may sacrifice depth in certain subdomains. For instance, specific ethical tensions unique to clinical versus educational settings could not be fully differentiated due to the integrative nature of the methodology. Future research should prioritize participatory, empirical studies involving adolescents with cognitive disabilities as co-researchers. Qualitative methods such as interviews, ethnographic observation, and participatory design workshops would allow for richer, context-sensitive insights into lived ethical experiences. Longitudinal studies are also needed to explore the evolving ethical dynamics of AT use over time, especially as adolescents mature and as technologies become more sophisticated. Additionally, more research is warranted in underrepresented settings, particularly in low-resource and culturally diverse contexts, to inform equitable global standards for ethical AT deployment.

6. Conclusions

Assistive technologies hold immense promise for supporting adolescents with cognitive disabilities in achieving greater independence, communication, and social participation. However, this promise is tempered by substantial ethical challenges. By centering consent, autonomy, privacy, accessibility, and equity, stakeholders can ensure that AT contributes positively to adolescent development.

Ethical implementation of AT must be rooted in a developmental understanding of adolescence [26] a life stage marked by identity formation, social exploration, and increasing self-determination. Ongoing professional development and cross-disciplinary collaboration are crucial to ensuring ethical implementation of AT [20].For adolescents with cognitive disabilities, this period can be particularly complex as they navigate their capabilities and aspirations within systems that may not always accommodate or affirm them. AT should therefore serve not just as a functional tool but as a means to support holistic development and social inclusion.

One of the primary takeaways from this review is the importance of viewing ethical considerations as dynamic rather than static. Ethical deployment of AT cannot be reduced to a set of fixed principles applied uniformly across all cases. Rather, it requires ongoing engagement with context, culture, and individual lived experience. Adolescents grow, their capacities change, and technologies evolve. This necessitates adaptable frameworks that remain sensitive to emerging needs and ethical dilemmas.

Practitioners, policymakers, and developers need to invest in capacity-building to navigate these ethical terrains. Training programs for teachers, therapists, and caregivers should include not only technical instruction but also ethical literacy, helping them recognize potential tensions and respond with empathy and respect. Institutions must also create mechanisms for ethical review and accountability that include input from adolescents and their families. For example, a school-based assistive technology program could include monthly workshops where staff are trained not only in using communication devices or navigation tools but also in case-based ethical scenarios, such as when prioritizing a learner's autonomy over safety concerns. These sessions could be complemented by a student and caregiver advisory panel that reviews the ethical implications of new AT policies or technologies being introduced into the school environment.

The call for longitudinal research is particularly urgent. While short-term studies may demonstrate the immediate benefits of AT, they often overlook how technologies shape development over time. For instance, a speech-generating device may improve classroom participation in the short run, but what are its long-term effects on self-esteem, social integration, or dependence? Similarly, wearable trackers may initially support mobility and safety, but how do adolescents feel about being monitored as they age? Longitudinal designs can uncover both intended and unintended consequences and help shape more ethically sound interventions.

Participatory research is another key pillar of ethical AT development [30]. Adolescents with cognitive disabilities must be engaged not only as subjects but as co-researchers, designers, and evaluators of the technologies that affect their lives. Their insights can illuminate gaps in design, challenge assumptions held by developers, and ultimately produce more effective and respectful tools. Participatory approaches also affirm adolescents' rights to agency and voice, aligning ethical practice with broader commitments to inclusion and empowerment.

Policy development should move beyond generic accessibility mandates and embrace a broader ethics of care and justice. Public and private sector investment in AT should prioritize equity in distribution, inclusive procurement processes, and affordability. Government and institutional policies should support user-driven innovation and ensure that ethical risks are considered alongside technical performance. In doing so, the broader system of support around AT becomes not only more inclusive but also more robust and future ready.

Ethical AT implementation is not a checklist but a continuous process of reflection, adaptation, and collaboration. These findings point toward the necessity of integrating models like the difference model, which emphasizes qualitative distinctions in how individuals with intellectual disabilities process tasks and make decisions. This approach should inform not only AT design but also training practices for caregivers and educators [4]. It requires all stakeholders’ adolescents, families, educators, clinicians, developers, and policymakers to engage in dialogue, ask difficult questions, and remain open to evolving understandings of what it means to support adolescents with cognitive disabilities. Ultimately, assistive technologies should not merely accommodate difference; they should celebrate it, creating pathways for adolescents to thrive on their own terms and in communities that value their full participation. Collectively, while the 20 studies provide a solid foundation, future research must expand the evidence base through longitudinal and participatory designs. This includes integrating adolescents lived experiences to capture the nuanced impacts of AT over time.

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Abbreviations

The following abbreviations are used in this manuscript:

AT	Assistive Technology
AI	Artificial Intelligence
LMIC	Low- and Middle-Income Country
WHO	World Health Organization
UN	United Nations

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