Digital Technology, Employment Opportunities and Functional Independence for Young Adults with People with Disability: A Scoping Review

Deepti Anand[1], and Maleeta Angelina Goddard[2]

[1]IDCONS TECHNOVA PRIVATE LIMITED (ITPL), New Delhi, India

[2]IDC India — Innovation Development Council, New Delhi, India

Author Note

Deepti Anand https://orcid.org/0009-0003-7685-466X

Maleeta Angelina Goddard https://orcid.org/0009-0006-8540-9498

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Correspondence concerning this article should be addressed to IDC India- Innovation Development Council, 5th Floor, Wing A, Statesman House, Barakhamba Road, Connaught Place, New Delhi – 110001, India. Email: editorial@idcijst.com

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Abstract

Digital technology has become an integral part of daily life, supporting communication, employment, learning, and independent living. However, limited research has examined the relationship between digital competence and functional self-sufficiency among young adults with Down syndrome (DS), a population for whom the transition to independent adulthood is a particular focus of clinical and educational attention. This scoping review maps existing evidence on the types and frequency of digital technology use among young adults with DS and examines how digital competence relates to functional independence and employment. It also considers whether demographic and community factors- age, education, employment status, and living arrangement which are associated with digital independence. Using a scoping review design, we identified eligible studies, screened them against predefined inclusion and exclusion criteria, and charted them using a structured data-extraction framework. Evidence was synthesised descriptively and thematically. Digital technologies were grouped by application area (communication, education, daily living, employment, financial activity, and workplace support), and employment outcomes were grouped by the type of work reported in the included literature. Reported relationships between digital competence, employment, and independence were examined across studies, and gaps in the existing literature were identified to inform priorities for future research and practice.

Introduction

Down syndrome (DS) is a genetic condition caused by the presence of an extra copy of chromosome 21 and is associated with varying degrees of cognitive, communication, and adaptive functioning. Although individuals with DS may require different levels of support throughout life, increasing attention is being given to supporting autonomy, participation, and independent living. Digital technology has become an integral part of everyday activity, including communication, education, navigation, financial transactions, healthcare, and employment. Smartphones, tablets, computers, and digital applications may give individuals with DS tools that support learning, communication, decision-making, and the completion of daily activities with reduced assistance.

Functional independence is particularly important during the transition from adolescence to adulthood. Research has demonstrated substantial variation in daily living skills among adults with DS: in one multidisciplinary clinic cohort, adults were more likely to be independent in activities such as feeding, dressing, and toileting, while considerably fewer were independently able to cook

(Matthews et al., 2018). The same study found that most adults lived with family members, while smaller proportions lived independently, with roommates, or in group homes.

Digital competence the ability to actually operate and apply technology, rather than simply possess it may therefore represent an increasingly important component of functional independence. Research explicitly examining technology use among people with DS remains relatively limited, however. Morris and colleagues investigated technology, gaming, and social-media use among individuals with DS using responses from 220 parents and caregivers of people aged 5–35 years (Morris et al., 2024). Technology and social media played an important role in the lives of many participants, but caregivers also reported substantial difficulties: more than half reported difficulties with mice, trackpads, keyboards, and voice-activated technology, and only 20.5% of individuals were reported to operate technology independently.

These outcomes point to an important distinction between access to technology and digital competence. Ownership or availability of a smartphone or computer does not necessarily mean that a person can independently use the device to communicate, access information, navigate, manage schedules, or complete other everyday activities.

Assistive technologies may help close this gap. A systematic review examining assistive technologies for people with DS identified 24 studies from an initial pool of 564 papers and concluded that emerging assistive technologies have the potential to support functional skills and

independent living, while also noting substantial variation in technologies, applications, and individual needs (Krasniqi et al., 2022). Individual interventions provide further evidence: a feasibility study involving 26 children with DS found that an assistive technology approach that combined smart-device software with step-by-step visual instructions was associated with parent-reported improvements in activities of daily living, quality of life, and independence. Although this study included children rather than young adults, it illustrates the promise of digital tools to support functional skills.

The relationship between technology and independence is also reflected in quality-of-life research. A mixed-methods systematic review of 39 studies involving adults with DS (Ijezie et al., 2023) found that independence and self-determination were important components of quality of life, and several studies reported benefits associated with information and communication technologies, including calendars, reminders, social media, and communication tools.

Despite this, access to technology does not necessarily mean that an individual can use it independently. Digital competence, including the ability to operate devices, access information, communicate, use applications, and perform digital tasks safely, may be an important factor in determining whether technology contributes to functional independence. There is limited research examining how digital competence is associated with functional self-sufficiency among young adults with DS specifically.

The present study therefore aims to assess the types and frequency of digital technology used by young adults with DS and to examine the relationship between digital competence and functional independence. It also explores whether demographic and community factors age, education, employment status, and living arrangement- are associated with digital independence. Knowing these relationships may help families, educators, healthcare professionals, and support organisations develop strategies to strengthen digital skills and promote greater self-reliance among young adults with DS.

Research Gap

The literature demonstrates three important gaps.

First, although there is evidence that people with DS use digital technologies, information about the frequency, type, and degree of independent use remains limited. A 2023 caregiver study specifically identified limited information on technology availability and use and highlighted difficulties in independent operation.

Second, although assistive technologies have demonstrated possible benefits for independent living, the evidence is heterogeneous. The systematic review of 24 studies identified considerable variety in technologies and emphasised that many questions concerning individual needs and capabilities remain unresolved.

Third, independence research and technology research have often been conducted separately. Independence studies tend to examine adaptive behaviour and daily living, whereas technology studies more often examine technology adoption or specific interventions. There is comparatively little evidence directly examining digital competence as a potential contributor to functional independence.

The present review therefore addresses the following gap:

There is limited integrated evidence examining how everyday digital technology use and digital competence may relate to functional independence in young adults with Down syndrome, and how demographic and community factors may shape digital independence.

Methodology

A scoping review design was used to map the available literature on digital technology use and functional independence in individuals with DS. A scoping approach was selected because the available literature spans quantitative studies, qualitative studies, feasibility studies, intervention studies, caregiver surveys, and previous reviews, rather than a sufficiently homogeneous body of studies suitable for meta-analysis.

Search Strategy

Literature was searched using combinations of the following keywords:

"Down syndrome" OR "Trisomy 21"

AND

"digital technology" OR "technology use" OR "smartphone" OR "tablet" OR "computer" OR "social media" OR "assistive technology" OR "digital competence"

AND

"independence" OR "functional independence" OR "daily living" OR "adaptive functioning" OR "autonomy" OR "self-determination".

Additional reference-list (backward citation) searching was undertaken to identify relevant studies not retrieved through the primary searches.

Eligibility Criteria

Studies were considered eligible if they met the following criteria:

- Population: individuals with Down syndrome, with particular relevance to adolescents and young adults;
- Concept: use of digital or assistive technology, digital competence, or digital skills;

- Context: any setting in which technology use, independence, or employment was examined (home, community, education, or workplace);
- Study types: quantitative, qualitative, and mixed-methods primary studies, feasibility studies, and systematic or other reviews.

Data Charting and Synthesis

Information was extracted from eligible studies using a structured data-extraction framework covering study design, sample characteristics, type of technology, outcome measures, and key findings relevant to functional independence, digital competence, and employment. Extracted evidence was synthesised descriptively and thematically. Digital technologies were categorised according to their application: communication, education, daily living, employment, financial activity, and workplace support, and employment-related findings were grouped according to the type of work reported in the literature. Reported relationships between digital competence, employment, and independence were then examined across the included studies.

Overview of Available Evidence

The literature identified through the review indicates that research on digital technology and DS is emerging but remains relatively small and heterogeneous.

A 2022 systematic literature review screened 564 papers published after 2015 and ultimately included 24 studies examining assistive technologies and independent living for people with DS (Krasniqi et al., 2022). The review concluded that emerging technologies have potential to support functional skills and independent living, but highlighted substantial variation in technologies, needs, and capabilities.

A more recent study *carefully examined* technology use among people with DS through caregiver reports (Morris et al., 2024). The study included 220 caregivers of individuals aged 5–35 years and provides some of the clearest available evidence regarding technology availability and everyday use.

Types of Digital Technology

The literature indicates that individuals with DS use a range of digital technologies, including:

- Smartphones
- Tablets
- Computers
- Internet-based communication
- Social media
- Gaming technologies

- Mobile applications
- Smart-home technologies
- Assistive communication technologies
- Visual/step-by-step digital systems

Smartphones and mobile devices appear particularly relevant to everyday life: in a multidisciplinary clinic cohort, 52% of adults with DS were reported to use a smartphone or other mobile device (Matthews et al., 2018). Technology is used not only for entertainment but also for communication, social interaction, information access, reminders, daily tasks, and, potentially, independent living. A quality-of-life systematic review reported that ICT use among adults with DS was associated, in several studies, with autonomy, self-determination, communication with family and friends, useful applications, calendars, social media, and reminders (Ijezie et al., 2023).

Frequency and Independent Use

Although technology is widely present in the lives of people with DS, independent use is considerably more variable. The caregiver study by Morris and colleagues (2024) found that technology and social media were considered important in the lives of many individuals with DS; however, caregivers identified significant difficulties operating technology, including with mice, trackpads, keyboards, and voice-activated technology. Only 20.5% of individuals were reported to operate technology independently, and only 14.2% were considered to find new technology easy to

learn. These results indicate that technology availability and technology independence are distinct outcomes.

Digital Competence and Functional Independence

Direct studies examining the statistical relationship between digital competence and functional independence in young adults with DS are limited. Nevertheless, converging evidence suggests a potentially meaningful relationship. The assistive-technology systematic review concluded that technology can contribute to the development of functional skills required for independent living (Krasniqi et al., 2022). A smart-home intervention among adults with DS reported positive effects on living skills, self-determination, quality of life, and mental well-being (de Oliveira et al., 2022), and an assistive-technology feasibility study involving children with DS found improvements in activities of daily living, independence, and quality of life following a smart-device-based intervention.

These studies provide supportive evidence, but they do not establish that general digital competence independently predicts functional independence. The evidence therefore supports the proposition that digital competence may facilitate independence, but stronger, direct research is required.

Functional Independence

Functional self-sufficiency among individuals with DS is highly variable. A large caregiver study conceptualised independence across safety, communication, self-care, daily living, social/leisure, and vocational domains, emphasising that independence is complex and multifactorial (Santoro et al., 2022). A separate multidisciplinary clinic study found that adults with DS demonstrated different levels of independence across activities of daily living: independence was relatively high for feeding and dressing but substantially lower for cooking and other complex activities (Matthews et al., 2018), and more recent evidence links change in daily-living function to lower community participation (Caldwell et al., 2025). A systematic review of quality of life similarly found that adults with DS value autonomy, self-determination, independent living, community participation, as well as decision-making (Ijezie et al., 2023). Functional independence should therefore not be treated as a single ability; digital technology may support some dimensions more readily than others.

Age, Education, Employment and Living Arrangement

The literature suggests that independence is determined by multiple individual and environmental factors. Age may be relevant because adaptive functioning and independence can change across adulthood; one longitudinal study of adaptive behaviour in adolescents and adults with DS reported changes over time (Spiridigliozzi et al., 2019), although this finding does not specifically establish an effect of age on digital independence. Education may provide opportunities

to develop literacy, communication, technology, and decision-making skills, and research on meaningful literacy in adults with DS emphasizes the increasing importance of reading and electronic communication for functioning in contemporary society.

Employment may also provide opportunities to practice technology and independent skills: research examining adaptive behaviour and employment in young adults with DS found an association between aspects of executive functioning and employment status (Tomaszewski et al., 2018). Living arrangement is another potentially important environmental factor, research indicates that adults with DS live in a variety of settings, including with family, independently, with roommates, and in supported or group-home environments (McCarron et al., 2008). The literature therefore supports investigating these factors, but evidence specifically linking them to digital independence *is still insufficient*.

Discussion

The findings of this scoping review indicate that digital technology is already an important part of life for many individuals with DS, but the ability to use technology independently varies substantially.

The most important finding is the distinction between technology availability and digital competence. Although many individuals have access to smartphones, computers, social media, and other digital technologies, independent operation remains limited for some users; the caregiver

study reporting that only 20.5% of individuals could operate technology independently illustrates the gap between access and competence. This distinction has practical significance: providing a smartphone or computer to a person with DS may not automatically increase independence. The individual may require accessible interfaces, visual instructions, repeated practice, simplified navigation, caregiver support, or individualised training.

The evidence from assistive-technology interventions is encouraging. Smart-device-based interventions and smart-home technologies have been associated with improvements in daily living, self-determination, autonomy, and quality of life (de Oliveira et al., 2022). However, these studies frequently involve small samples or specific technologies and therefore cannot establish that digital competence generally causes increased functional independence.

Independence is also multidimensional. It includes communication, self-care, safety, daily living, social participation, decision-making, and employment, and digital technologies may contribute differently to each domain. Smartphones may support communication and emergency contact; navigation applications may support community mobility; reminders may support daily routines; and electronic communication may facilitate social participation. More advanced functions, such as online banking or digital payments, may require greater cognitive and financial skills.

The review also highlights the importance of directly involving people with DS in technology research. Much of the available evidence, including the large technology-use study (Morris et al., 2024), relies on caregiver reports. However, quality-of-life research has demonstrated differences between self-reported and proxy-reported perceptions among adults with DS (Ijezie et al., 2023). Future technology studies should therefore include the views and experiences of people with DS themselves wherever possible.

Employment also deserves attention. It may provide a real-world environment in which individuals practise communication, organisation, technology, and decision-making skills. A long-running inclusive employment program reported technology as one of seven fundamental job-skill categories, alongside communication, teamwork, professionalism, independence, organisation, and clerical skills ,suggesting that digital competence may have relevance outside personal independence and may contribute to workplace participation.

Research Proposition

Because this is a scoping review rather than a primary quantitative study, a formal statistical hypothesis is not tested. Nevertheless, the evidence supports the following proposition:

Digital competence may be positively associated with functional independence of young adults with Down syndrome, while age, education, employment status, and living arrangement may contribute to differences in digital independence.

This proposition should be tested in future primary research.

Consequences for Practice

The findings contain a number of practical implications.

1. Digital skills should be included in transition programs

Digital competence should be considered alongside traditional life skills such as cooking, transportation, communication, and money management.

2. Training should focus on real-life applications

Rather than teaching technology only as a recreational activity, training could focus on:

- Communication
- Navigation
- Reminders
- Appointments

- Emergency contact
- Online safety
- Digital payments
- Accessing services
- Workplace applications

3. Accessibility should be individualised

Technology should be adapted to the individual's cognitive, communication, visual, and motor abilities.

4. Caregivers should facilitate rather than replace independence

The goal should be to provide the minimum support, facilitating individuals to practise and perform tasks themselves.

5. Digital safety should be part of independence training

Online scams, privacy, inappropriate communication, passwords, and social-media safety should be incorporated into digital-skills programs.

Limitations of the Review

This review has several limitations.

- The literature concerning digital technology and DS is relatively heterogeneous, making direct comparison between studies difficult.
- Many studies rely on caregiver or proxy reports instead of direct reports from individuals with DS.
- Technology changes rapidly, so findings from older studies may not fully represent current smartphone, application, social-media, and digital-payment environments.
- The evidence base includes studies involving children, adolescents, and adults; findings therefore cannot always be generalised specifically to young adults.
- Because this review is a scoping evidence synthesis rather than a meta-analysis, it does not provide a pooled estimate of the relationship between digital competence and functional independence.

Conclusion

Digital technology has considerable potential to support *self-reliance among* young adults with Down syndrome. The existing literature demonstrates that smartphones, computers, applications, social media, assistive technologies, and smart-home systems can support communication, daily living, self-determination, and autonomy.

However, access to technology does not necessarily translate into independent use. Evidence indicates that some individuals with DS experience considerable difficulty operating devices and learning new technologies, stressing the importance of digital competence and individualised support.

The relationship between digital competence and functional independence remains an important evidence gap. Existing intervention studies provide promising indications that technology can support independence, but the available evidence is not sufficient to establish a general causal relationship. Age, education, employment, and living arrangement may also shape opportunities to develop and use digital skills, but their specific relationship with digital independence has not been adequately studied.

Future research needs to move toward participant-centred, longitudinal, and intervention-based studies that directly assess digital competence and functional self-sufficiency among young adults with DS. Such research would inform practical digital-skills programs

designed not simply to increase technology use, but to enable individuals with DS to communicate, travel, work, manage daily activities, make decisions, and participate more independently in society.

Ultimately, digital inclusion should be understood not simply as access to technology, but as the ability to use technology independently, safely, meaningfully, and purposefully.

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