Digital Literacy in People with Disabilities: An Overview and Narrative Review

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Abstract

Digital literacy refers to the ability to effectively use digital technologies for tasks such as finding, evaluating, creating, and communicating information. It is particularly beneficial for people with disabilities as it opens up opportunities for them in the digital world. To ensure their full participation, efforts to promote digital literacy should prioritize inclusive design principles. People with disabilities often rely on assistive technologies like screen readers, alternative input devices, voice recognition software, or specialized hardware to navigate digital platforms. Therefore, digital literacy programs should not only focus on consuming content but also on creating and sharing it through various mediums. Peer support and collaboration play a crucial role in enhancing their learning experience. In addition to teaching digital skills, these programs should address cybersecurity and online safety considerations specific to such people. They should provide training and support for using assistive technologies effectively, while also educating them about potential risks, privacy settings, and safe online practices. A review of available research on digital literacy for people with disabilities revealed a growing number of publications in recent years. However, the topics covered in these publications are unevenly distributed, leaving room for future research to focus on areas such as measurement and training of digital literacies for both teachers and students with disabilities. By promoting digital literacy among individuals with disabilities, we can bridge the digital divide and empower them to fully participate in today's increasingly digital society.

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Abbreviations

ADA: Americans with Disability Act; ADD/ADHD: Attention Deficit/Hyperactivity Disorder; AR: Augmented Reality; ASD: Autism Spectrum Disorder; AT: Assistive Technology; CWDs: Children with Disabilities; DHH: Deaf or Hard of Hearing; DL-Digital Literacy; ICT: Information Communication Technology; ID: Intellectual Disabilities; IOT: Internet of Things;IT: Information Technology; LD: Learning Disabilities; NISA; National Information Society Agency; PWDs: People with Disabilities; QOL-Quality of Life; SMI: Severe Mental Illness; VR: Virtual Reality.

Introduction

The term “information literacy” has evolved into “digital literacies” due to the shift from the information age to the digital age (Becker, 2018). This change has been brought about by digitization, which has led to a transition from print to on-screen reading and writing (Dobson & Willinsky, 2009). The digital revolution has had a significant impact on our daily lives, including those of people with disabilities (PwDs), who face challenges in accessing and using digital technology due to their physical limitations (Crammer, 2021). They also face discrimination and stigma in addition to their difficulties. Ther various types of disabilities include physical, sensory, cognitive, psychiatric, developmental, and sometimes invisible disabilities (Venkatesan, 2004). Harris, Harris, and Sally (1998) examined how children with disabilities aged 4 to 11 years old utilized computers both at home and in school. Their computer usage was facilitated by simplifying and repeating

tasks, minimizing distractions and irrelevant stimuli, providing models and demonstrations, offering ample practice opportunities, delivering instructions in manageable steps, and providing immediate or frequent reinforcement with feedback. Positive attitudes of parents and teachers played a crucial role in fostering computer literacy skills in these children.

Digital Divide

There is a significant disparity between individuals without disabilities and PWDs in various aspects of life, including physical access, employment opportunities, healthcare, social integration, and education. This gap is further widened by the "digital divide," which presents additional challenges for disabled individuals. Many websites are inaccessible to those with visual impairments due to issues like text color, size, layout, and compatibility with screen readers. Others may struggle with using input devices or extended periods of gadget usage. Unlike unaffected individuals who can easily seek alternative internet access, PWDs face additional considerations such as transportation, wheelchair accessibility, ramps, lifts, and restroom facilities when leaving their homes. Research has shown that individuals without disabilities who have higher education levels, household incomes, motivation for internet use, and stronger digital literacy (DL) skills tend to experience more favorable outcomes compared to PWDs.

Critics of the concept of the digital divide argue that the gap between individuals with and without internet access will eventually diminish in the future. The Diffusion of Innovations Theory (Rogers, 1986) suggests that the increasing use of technology as a market force, rather than relying solely on policies, will contribute to the elimination of this divide (Rogers, 1962-2003). Indicators of the digital divide include the availability and affordability of internet connectivity, ownership of digital devices, and proficiency in digital skills. However, it is important to note that PWDs are typically less likely to be online. They face inequities and barriers in accessing digital tools and content. Enhancing their DL skills and reducing the digital divide is essential for promoting inclusion, social participation, livelihood opportunities, and overall quality of life (QOL), as mandated by UNESCO's Sustainable Development Goal #4 (Compaine, 2001).

MIlestones in The History of Computers and PWDs

Year	Milestone
1808	Pellegrino Turri built the first typewriter to help a blind friend write legibly.
1886	Herman Hollerith, who had a cognitive processing disability, developed the idea of using punch cards to transfer data from the 1890 census and founded the Tabulating Machine Company.
1960s	Assistive Technologies (AT) for individuals with visual impairments, such as screen readers and braille displays, were developed. Early devices included the Optacon and “Telesensory.”
1970s	Adaptive input devices like alternative keyboards and switches were developed to provide access to individuals with motor impairments.
1980s	Graphical user interfaces (GUIs) and speech recognition software expanded accessibility options for PWDs, with advancements in speech recognition and screen reading software.
1990s	The Americans with Disabilities Act (ADA) was passed, increasing focus on accessibility in technology and leading to the development of standards and guidelines.
2000s	Mobile devices and touch-screen technology emerged, opening up new possibilities for accessibility, including eye-tracking, gesture-based input, and voice-controlled interfaces.
2010s	Wearable devices like smartwatches and head-mounted displays, along with VR/AR technologies, are used in therapeutic settings to enhance mobility, cognitive skills, and sensory experiences.
2020s	The concept of universal design promotes accessible technology, and AI enables personalized assistance tailored to specific needs. Online platforms have increased accessibility in education and employment.

In the prevailing state of technology, **Brain-Computer Interfaces** enable individuals with severe and multiple disabilities to interact with digital devices using their thoughts instead of traditional input methods such as keyboards or touchscreens. **Voice Recognition and Natural Language Processing** in digital devices facilitate the hands-free operation of devices and enable individuals with speech impairments or cognitive disabilities to communicate more effectively. **Haptic Feedback technology** enables individuals with visual impairments to receive sensory feedback through touch or vibration, enhancing their interaction with digital devices. **Augmented Reality** technology enables interactions with digital content in more immersive and engaging ways by providing visual cues and navigation assistance for individuals with visual impairments, as well as those with cognitive disabilities (Hutinger, 1996; Hutinger, Johanson, & Stoneburner, 1996; Hutton, 1997; McMillan & MacArthur, 1991; Semmel & Lieber, 1990; Viadero, 1997).

Digital Literacy

DL encompasses the skills needed to effectively navigate and utilize information and communication technologies (ICTs) and the internet. It is crucial for functioning in a society where communication and access to information primarily occur through digital technologies such as social media, internet platforms, and mobile devices. Initially defined by Gilster (1997), DL involves understanding and using information from various sources in multiple formats presented via computers. It requires knowledge of technology's capabilities, limitations, risks, and safety measures. DL encompasses locating, evaluating, creating, and communicating information using ICTs. However, the meaning of DL has evolved over time and can vary depending on the context, whether it be for media, entertainment, education, or career purposes (Treglia et al., 2019; McDougall, Readman & Wilkinson, 2018; Hartley, 2017; Chase & Laufenberg, 2011). DL requires both cognitive and technical abilities and positively impacts an individual's QOL and self-esteem. However, PWDs may face challenges in accessing digital content. For example, smartphones may not be compatible with hearing aids for the

deaf, touch screens may be difficult for those with motor impairments, and web pages may lack text labels needed by screen reading software used by the blind (Mengual-Andrés et al., 2020). Augmentative technologies offer alternative communication methods for such individuals (Botelho, 2021). Various sources have discussed the similarities and differences in the basic concepts of DL (Beliveau & Wiesnger, 2023; Parker & Reddy, 2019; Julien, 2018; Wempen, 2014).

Martin & Madigan (2006) propose the term "Digital Literacies" instead of a singular form to encompass various components and cognitive-thinking strategies, a viewpoint supported by Knobel & Lankshear (2006). The definition of DL has evolved from focusing solely on computer programming skills in the 1960s to now encompassing a wide range of literacies such as IT and ICT literacy, web literacy, online reading, media literacy, meta-literacy, visual literacy, communication literacy, information literacy, computer literacy, e-literacy, network literacy, and other lay terms like "basic skills," "Internet savvy," or "smart working." Several authors have explored the origins and concepts of DL (Bawden, 2001; 2008; Bawden & Robinson, 2002; Kope, 2006; Martin, 2006a; 2006b; Williams & Minnian, 2007). Examples of DL skills include operating gadgets, navigating the internet, managing files in various applications, conducting online searches, using smartphones for communication and other applications, understanding device components, practicing online safety, making online payments, efficient keyboard usage, creating/editing documents (word processing, spreadsheets, presentations), utilizing copy-paste functions, sharing files, formatting content, and utilizing digital tools such as podcasts, Bluetooth, Wi-Fi, visual and graphic materials. DL also involve activities like commenting on blogs or forums, securing passwords, understanding basic programming languages and troubleshooting (Tinmaz et al. 2022; Bulger, Mayer, & Metzger, 2014; Ba, Tally, & Tsikalas, 2002). DL benefit students with disabilities in terms of academic performance, collaborative learning, self-efficacy, self-motivation, positive learning environments, communication, engagement both inside and outside the classroom, independence, and technological skills (Alsalem, 2016).

Digital illiteracy is the lack of knowledge and understanding of using digital tools and technology. The unavailability or inaccessibility of digital devices, limited internet connectivity, social and economic disparities, old age or illness, limited education, language or cultural barriers, fear or resistance towards technology, and lack of awareness are factors involved in digital illiteracy. It widens the digital divide, particularly among vulnerable groups such as the poor and elderly who are at risk of being excluded from mainstream society. It also affects employability and leads to a lower QOL (Datta et al. 2018; Fernando & Jain, 2022). Some individuals with chronic mental illnesses lack even basic digital skills like changing passwords, connecting to Wi-Fi, making online purchases, accessing healthcare services, or setting up an email account and hence their ability to adapt to modern digitization trends (Spanakis et al., 2022). Similarly, Camacho and Torous (2023) noted positive impact and significant improvements in these skills and clinical outcomes following DL training outreach programs among individuals with SMI.

Venkatesan (2021) introduced the concept of a potential "digital skills disorder" as a future disability that includes the lack of proficiency in technical and non-technical skills, such as using new-age gadgets, developing websites, apps or software, being a virtual netizen, and being tech-savvy. Governments worldwide are increasingly recognizing the economic impact of DL, now considered the fourth literacy. There is a strong case for implementing comprehensive

strategies that begin with early education and ensure that college graduates have essential technology competencies when entering the modern workforce (Murray & Pérez, 2014; Nelson, Courier, & Joseph, 2011).

Levels of Digital Literacy

DL is not a binary concept, but rather a spectrum that varies in the ability of individuals and communities to understand and use digital technologies in different life situations. To align with the Prime Minister's vision of "Digital India," the National Institute of Electronics and Information Technology (NIELIT), Ajmer, is implementing courses as part of the National Digital Literacy Mission (NDLM). This initiative provides computer skills training to eligible members from households in selected blocks across each state and union territory. The aim is to equip trainees with basic ICT skills that are relevant to their needs, enabling them to effectively use IT and related applications, actively participate in the democratic process, and enhance their livelihood opportunities. The training empowers individuals to access information, knowledge, and skills through digital devices at the nearest Training Centre/Common Service Center (CSC). The course structure includes two levels: Appreciation of DL and Basics of DL. The training is conducted in any of the official languages of India. Evaluation is carried out by a national-level certifying agency such as NIELIT, NIOS, or IGNOU. The levels of DL can be analyzed based on their basic usage, application, development, and transformation across three dimensions: cognitive, social, and technical aspects (Table 1).

PWDs have similar DL levels to their healthy peers, but they face additional challenges and considerations. There is need for studying levels of DL for addressing the digital divide, promoting education and employment opportunities, ensuring access to information, fostering social inclusion, and informing policy development in PWDs in the digital era. For instance, accessible technology such as screen readers or magnifiers must be used to overcome the barriers of inaccessible websites, apps, and documents that are incompatible with AT. Furthermore, they require additional training and support to develop DL skills, including accessible training materials, one-on-one support, and peer mentoring. For PIDs, teaching-learning materials should be presented in simplified language with visual aids. Tailor-made individualized interactive learner-paced training with peer tutoring and positive feedback can also be beneficial. DL programs for them must take into account their unique needs and challenges (Ayyildiz, Yilmaz, & Baltaci, 2021).

Park & Nam (2014) compared the DL of PWDs to unaffected controls based on data collected from the National Information Society Agency (NISA) in Korea regarding their internet and smart device usage. They dound significant effects of disability, gender, age, and education on internet use and production literacy. Tohara (2021) explored DL tools and strategies utilized by students with special needs in Malaysia from their perspective and those of their teachers to develop effective DL tools and strategies that meet their unique needs.

Theories, Models and Perspectives on Digital Literacy

A brief compilation on theories, models, and perspectives especially those aligned for PWDs is given below since they are essential for understanding, researching, teaching, and promoting DL in these populations. They provide a foundation for

curriculum development, policy-making, professional development, and critical analysis in the field.

Table 1. Levels of Digital Literacy

Level/Duration	Required Qualification	Targeted Skills for Training
Apprentice (20 hours; 10-30 days training)	Illiterate to 7th grade completed	Build awareness on commonly used gadgets computers (Laptops, Desktops), mobile devices (Smartphones, Tablets), Servers, Routers and Switches, Printers and Scanners, Projectors and Screens, External Hard Drives and USB Flash Drives, Networking Cables (Ethernet, HDMI, USB), Wireless Adapters, Webcams and Microphones, Computer Monitors, Keyboards and Mice, Headsets and Speakers, UPS (UPS), Portable Chargers and Power Banks, interactive white boards, ipods, gaming consoles, etc. Paint Programs, Educational and Puzzle Games, Storybook Apps, Virtual Coloring Books, Music Apps, Memory Games, etc.
Basic (40 hours; 20-60 days training)	8th grade; Above 14 years.	Use Word Processing, Spreadsheets, Presentation Tools, Coding Platforms, Educational Researcheliable information, and citing sources.Digital Art and Design, Virtual Science Experiments, Language Learning Apps, Mind Mapping, and Collaboration Tools. Email, Media players, Image editing, Video editing, Antivirus software, File compression and extraction,
Intermediate	High School pass	Application by accessing e-governance services provided to citizens, document creation, data management, use of social media, use of specialist AT like web browsers, search engines, Braille Notetaker, screen readers, Bluetooth, fitness trackers, virtual reality headsets
Advanced	Under graduation	Programming, Web Development, Database Management, Graphic Design, Multimedia Editing, Networking, Cybersecurity, Data Analysis, Presentation Skills, Problem Solving, etc
Expert	Graduation & Above	Software Development, Web Development Frameworks, Database Administration, Cloud Computing, Data Science, Cybersecurity Analysis, Project Management, Network Administration, Mobile App Development, Agile Development, etc. Advanced Algorithms and Data Structures, Artificial Intelligence and Machine Learning, Big Data Analytics, Cryptography and Blockchain, High-Performance Computing, Ethical Hacking and Penetration Testing, Natural Language Processing, Systems Architecture and Scalability, Software Engineering Leadership,

(Sources: Sung & Kim, 2020; Utaminingsih, 2022; Koppel & Langer, 2020; Uršej, 2019; Kimbell-Lopez, Cummins, & Manning, 2016).

i. Information Processing Model

This model focuses on how individuals process and interpret information in digital environments. It explores cognitive processes such as attention, perception, memory, and problem-solving skills.

ii. Socio-cultural Perspective

Allied with the Social Model of Disability, this perspective emphasize the social and cultural aspects of DL and recognizes the influences by individuals' social interactions, cultural backgrounds, and societal norms. An offshot of this model are theories based on Universal Design for Learning (UDL) which advocate for website developers to incorporate various means of representation, expression, and engagement to support diverse learners. This includes features like alternative text for images and video captions to assist users with visual or hearing impairments. Disability

is not seen as an inherent condition of an individual, but rather as a result of the barriers they encounter in society, including the digital realm (Oliver, 2013; Guo et al 2005).

iii. Critical Digital Literacy

This approach highlights the importance of critically analyzing and evaluating digital information. It aims to develop individuals' abilities to recognize bias, misinformation, and propaganda in digital content.

iv. Multiliteracies Framework

This frame recognizes that DL is just one aspect of a broader set of literacies including visual literacy, media literacy, and technological literacy needed in today's complex world. Other literacies include photo-visual literacy (interpreting graphical displays), reproduction literacy (creating new materials from existing ones using digital reproduction), branching literacy (navigating non-linear, hypertextual information), information literacy (evaluating the quality and validity of information), socio-emotional literacy (understanding social dynamics in cyberspace), and the ability to process large volumes of stimuli simultaneously (Eshet, 2004; Osterman, 2012; Eshet, 2012; Nawaz & Kundi, 2010; Sefton-Green, Nixon, & Erstad, 2009). This framework is applied in designing, evaluating, and training DL skills for PWDs as in school education through task analysis, shaping, modeling, guided practice, reinforcement, and prompting techniques (Hadjerrouit, 2010).

v. Digital Divide Theory

This theory explores the unequal access to digital technologies and the internet among different groups of people. It highlights the social and economic factors that contribute to the digital divide and the consequences it has on individuals' DL skills.

vi. Constructivist Learning Theory

This theory posits that individuals actively construct knowledge and meaning through their interactions with digital technologies. It emphasizes hands-on, experiential learning and encourages learners with disabilities to explore, experiment, and collaborate in digital environments.

vii. Technological Determinism or Assistive Technology Model

This perspective suggests that technology shapes society and individuals' behaviors. It is argued that DL is influenced by the affordances and constraints of digital technologies themselves. This involves, for example, the use of tools like screen readers, Braille displays, and voice recognition software to support individuals with visual or motor impairments.

viii. Transliteracy

This refers to the ability to read, write, and communicate across different platforms, media, and formats. It recognizes that DL extends beyond traditional text-based literacy and encompasses various modes of communication.

ix. Participatory Culture

This perspective emphasizes the importance of active participation and collaboration in digital spaces. It highlights the role of online communities, social media platforms, and user-generated content in shaping individuals' DL practices. According to the Compensation Model (Cummings et al 2002), PWDs often experience social isolation and limited interaction, both online and offline. By addressing these limitations and improving their social connections, they can overcome barriers and enhance their QOL. People who are socially inactive or dissatisfied in offline settings tend to

utilize the Internet more frequently, which can be beneficial for them.

x. Essential Digital Skills Framework (Eshet, 2004)

This encompasses various cognitive, motor, sociological, and emotional skills necessary for effective functioning in digital environments. The DL Skills Conceptual Model (Alkali & Amichai-Hamburger, 2004), or the recent South Pacific Digital Literacy Framework (SPFLF) were developed along these lines (Reddy, Chaudhary, and Hussein, 2023; Reddy, Chaudhary, & Sharma, 2020; Reddy, Chaudhary, Sharma, & Chand, 2022).

xi. Others

Chen's Theory of DL includes nine dimensions: communication, collaboration, critical thinking, creativity, citizenship, character, curation, copyright, and connectedness (Chen, 2015). Ibraimkulov et al. (2022) developed a two-component model of DL viz., operational skills and informational and strategic skills to assess the level of development of DL in students with hearing impairment from special (correctional) schools in Kazakhstan. Later validation of tools for measuring DL (Peled, Kurtz & Avidov-Ungar, 2021) based on archaic models (Gilster (1997) and the Technology Acceptance Model (TAM; Fred Davis, 1980) are also avalable. In sum, there is still no model/theory of DL exclusive for PWDs (Ali, Raza, & Qazi, 2023).

Objectives

Some key questions that can be raised regarding research on the theme of DL and PWDs include: What is the extent of existing research in this area? What are the specific topics and concerns that researchers have focused on? How have research interests evolved over time? What is the quality of the research and publications available? Additionally, there is a lack of research on the impact of digitization and digital technology on PWDs, particularly in addressing their prevalence, challenges, and concerns related to integrating the digital world into their lives. It is important to examine the differences in accessibility, employment, social inclusion, and education between PWDs and unaffected individuals. Furthermore, there is a need for evaluation tools to measure digital parameters in PWDs. Conducting a literature review on DL in PWDs is crucial for improving their QOL and implementing effective digital training programs. The objectives of this study were:

i. To attempt a comprehensive qualitative and quantative analysis of un- annotated bibliographic listing of books and citations compiled on digital literacy vis-a-vis people with disabilties;
ii. To examine the themes, topics and issues on or about disparities in accessibility, employment opportunities, social inclusion, and education options between people with disabilities and those without; and,
iii. To explore the availability of measurement tools for assessing digital aspects in people with disabilities.

Method

The key-terms DL and PWDs were used in the bibliographic search undertaken till the end of November, 2023, on internet search engine databases. The focus of the review was books, chapters, and publications that discussed various aspects

of DL in PWDs, including its meaning, characteristics, types, sources, dynamics, measurement, benefits, applications, and negative aspects. Only original research articles published in English ISSN journals and ISBN books were included. Descriptive essays, newsletters, periodicals, unpublished dissertations, and incomplete or misleading cross-references were excluded. The collected list of references was compiled in Microsoft Excel spread sheet under appropriate headings along with distinct codes to enable their categorization and classification. To minimize bias, inter-observer reliability checks were conducted by two independent coders who were blinded to each other's work, resulting in a robust correlation coefficient (r: 0.94). Ethical considerations were prioritized to ensure the representation of diverse ethnic groups and their subjective experiences (Venkatesan, 2009). Statistical analysis using SPSS/PC (Pallant, 2020) and Cohen's guidelines were employed to analyze effect sizes (Cohen, 1992). The production of this publication made efforts to adhere to PRISMA standards.

Results

The aggregated data of references on DL vis-a-vis PWDs are classified into harvest plots by their format, timelines, topics or themes respectively (Table 2). In this review, the majority of publications were Original Research Articles (N: 143 out of 196; 72.96%), while books (N: 26 out of 196; 13.27%), chapters (N: 12 out of 196; 6.12%), review articles (N: 9 out of 196; 4.59%), and proceedings of seminars (N: 3 out of 196; 1.53%) were less common. *The Journal of Adolescent and Adult Literacy* had the largest proportion of publications with 14 articles, followed by "*Computers & Education*" and "*Nordic Journal of Digital Literacy*," with five articles each. The number of publications on DL has increased six-fold from the year 2000 (N: 10; 5.10%) to the 2020s (N: 55; 28.05%). Research topics focused on DL and PWDs in general (N: 22 out of 196; 11.22%), and examining DL against subtypes of disabilities (N: 42 out of 196; 21.43%). Within subtypes, most publications were on PIDs (N: 17 out of 196; 8.67%), followed by research on PH (N: 8 out of 196; 4.08%) and HoH/Deaf (N: 7 out of 196; 3.57%). Training in DL (N: 25 out of 196; 12.76%) and measures of DL (N: 16 out of 196; 8.16%) were the most studied topics. Theories, paradigms, or models of DL, digital rights or their violations, and ethical issues were given less priority.

There is discrepancy between the search-engine extract of a list of journals focused on publishing research articles in DL and the list of journals as identified in this study (Table 3).

Table 2. Harvest plot showing the frequency distribution of compiled literature on DL in PWDs

Variable	N	%
Format		
ORA	143	72.96
Books	26	13.27
Chapters	12	6.12
Reviews	10	5.10
Proceedings of Seminars	5	2.55

Sub Total: 196		
Journals	**153**	**78.06**
(i) Computers & Education	5	2.55
(ii) Nordic Journal of Digital Literacy	5	2.55
(iii) Issues in Informing Science & Information Technology	4	2.04
(iv) Journal of Special Education Technology	4	2.04
(v) Disability & Society	3	1.53
(vi) Education & Information Technologies	3	1.53
(vii) Journal of Intellectual Disabilities	3	1.53
Sub Total: 27		
Time-lines		
<2000	10	5.10
2001-2010	27	13.78
2011-2015	36	18.37
2016-2020	68	34.69
2020>	55	28.06
Sub Total: 196		
Topics*		
DL	145	73.98
PWDs	22	11.22
Disability-Specific;		
(i) PIDs	17	8.67
(ii) PH	8	4.08
(iii) HoH/Deaf	7	3.57
(iv) SLD	5	2.55
(v) PVI/Blind	2	1.02
(vi) ADHD/ASD	2	1.02
(vii) PMI	1	0.51
Sub Total: 42		
Training	25	12.76
Measures	16	8.16
Gadgets (mobile, internet, email, computers, etc.)	15	7.65
COVID/Corona	6	3.06
Digital Divide	3	1.53
Inclusion	3	1.53
Training Teachers	3	1.53
Training Students	3	1.53
Grand Total	**196**	

Since the topics of research are multiply classified, their total is not likely to match the grand total

Table 3. Rank list comparison of journals

Search Engine Extracts	Present Study
1. Computers & Education 2. Digital Literacy Studies 3. Educational Technology Research and Development 4. International Journal of Digital Literacy and Digital Competence 5. Journal of Digital Literacy 6. Journal of Educational Computing Research 7. Journal of Research on Technology in Education	1. Computers & Education 2. Disability & Society 3. Education & Information Technologies 4. Issues in Informing Science & Information Technology 5. Journal of Intellectual Disabilities 6. Journal of Special Education Technology 7. Nordic Journal of Digital Literacy

Disability-Specific Studies

Individuals who have limited mobility or physical disabilities often require hardware modifications and adaptations more than changes in software. They can include specialized keyboards, foot pedals, mouth sticks, or input devices that utilize eye tracking to navigate the virtual world. Voice recognition software is also beneficial for individuals with limited mobility (Lowenthal et al., 2022). Arslantas and Gul (2022) examined the DL skills of university students with visual impairment in Turkey by using a mixed methods approach. The findings indicated that the participants had high levels of self-reported technical and cognitive DL skills but lower levels of social DL skills. While they possessed basic skills for accessing information and creating files, they lacked proficiency in areas such as information management, collaboration, communication, and digital content creation.

To ensure accessibility for individuals with blindness, it is crucial to provide assistive devices like screen readers or design websites and navigation aids that cater to their needs in the virtual world. Another study by Mardiana, Suminar, and Sugiana (2019) involving blind and low-vision students in an Indonesian Special Schools found that these students were active internet users with good DL skills in terms of responsible and polite digital communication. The students reported spending more than four hours a day on the internet primarily for information search, followed by social media usage. Some students showcased their ability to create creative content, such as tutorials uploaded on YouTube, utilizing digital media.

In summary, individuals with limited mobility or physical disabilities often require hardware adjustments, while individuals with visual impairment may face challenges in certain areas of digital literacy. However, with appropriate assistive devices and inclusive design, accessibility can be enhanced, allowing individuals with disabilities to engage effectively in the digital world.

The DL skills in **people with intellectual disabilities** (PIDs) have received research attention for the levels, extent, depth, form, types, and content. A particular form of **functional DL is** noted to be relevant for these people. Just as Functional Literacy has to do with writing or signing one's name, reading street signs, preparing a grocery list, filling out forms related to government schemes, and many other such things to lead a productive life and participate fully in society, functional DL is to with basics like sending and receiving email messages, scanning, photographing, uploading, and sharing documents.

Functional DL for PWDs involves understanding how to advocate for their digital accessibility needs and rights in various contexts, such as in the workplace or in accessing online services. DL opened the door to possibilities for fostering social connections, pursuing personal interests, and organizing everyday life in PIDs (Barlott et al. 2020).

Research has examined the DL skills of PIDs in terms of their levels, extent, depth, form, types, and content. Functional DL, in particular, has been identified as relevant for this population. Similar to how Functional Literacy encompasses skills such as writing or signing one's name, reading street signs, creating a grocery list, and completing government forms to lead a productive life and actively participate in society, functional DL involves basic tasks like sending and receiving email messages, scanning documents, taking photographs, uploading files, and sharing documents. For PIDs, functional DL also includes understanding how to advocate for their digital accessibility needs and rights in various contexts, such as the workplace or when accessing online services. DL has provided opportunities for PIDs to establish social connections, pursue personal interests, and effectively organize their daily lives (Barlott et al., 2020).

Caton and Chapman (2016) conducted a systematic review of ten primary studies published in English from 2000-2014 to investigate the usage of social media by PIDs. The studies were identified through electronic database searches, expert communication, and citation tracking. The findings revealed various obstacles that hinder PIDs' access to social media, including concerns about safety, difficulties arising from poor literacy and communication skills, cyber-language and cyber-etiquette, as well as issues with equipment accessibility and design. Borgström, Daneback, and Molin (2019) conducted a study that examined two peer-reviewed papers published between 2001-2017. They discovered these studies through electronic database searches, Facebook, and expert communication. The research focused on young PIDs and highlighted concerns related to online risks, vulnerability as victims of cyber-crime, and the need for support based on their sociability levels, loneliness, anxiety, depression, insight and judgment abilities, experiences of discrimination, deception detection skills, limited experience, and restricted life opportunities (Chadwick, 2019).

Social networks provide PIDs the opportunity to actively participate in society and enhance their self-determination. A question arises whether PIDs can effectively deal with unreliable information sources on the internet? It is shown that PIDs have a limited ability to evaluate recommendations in forums, which is attributed to atypical development rather than delayed development of these abilities (Salmerón, Gómez, & Fajardo, 2016). A research survey examined the online experiences, challenges, and preferences of adults with ID who used Facebook. The study reported 58 respondents using Facebook as frequently as non-disabled users to connect with family and friends in the real world. However, the respondents also highlighted challenges such as privacy settings and literacy demands (Shpigelman & Gill, 2014).

Observation and interviews of young adults aged 13-25 years with mild-moderate levels of IDs revealed that they preferred using icons, pictures, voice-based strategies, and videos when accessing the internet through smartphones, desktop devices, and tablets (Alfredsson-Ågren, Kjellberg, & Hemmingsson, 2020). Studies have also been conducted on the use of everyday technology such as digital stoves, cell phones, and elevators by PIDs. The studies recorded completion time from start to end of the task, number of errors, and help requests (Hällgren, Nygård, & Kottorp, 2014). Additionally, the use of smartphones to assist people with Down syndrome over seven recorded sessions through task sequencing found that they learned and performed better or faster when using AssisT-Task than traditional methods

(Gomez, Torrado, & Montoro, 2017).

The digital participation of PIDs is lower compared to individuals with other disabilities. This can be attributed to limited access to online content and technology, as well as inadequate DL skills. Additionally, social and economic barriers further hinder their engagement with digital technologies. Unfortunately, there are misconceptions that PIDs are incapable of using digital technologies or that such technologies are irrelevant or unbeneficial for them. However, with the right support and accommodations, many PIDs can effectively utilize digital technologies. Encouragingly, there has been a gradual improvement in the digital skills of PIDs in recent years (Heitplatz, Bühler, & Hastall, 2022; Heitplatz, 2020). A study by Li-Tsang et al. (2005) revealed that only around 6% of respondents with IDs knew how to use a keyboard, mouse, and access the internet, while approximately 33% were unable to operate a computer system at all. Despite having access to computers at home or in the workplace, they were often not allowed to use them. The study highlighted difficulties in training PIDs to use IT due to a lack of training techniques and suitable software. Furthermore, the views of parents and teachers significantly influenced their use of social media, as shown in a Swedish study (Molin, Sorbring, & Löfgren-Mårtenson, 2015; Näslund & Gardelli, 2013).

Khanlou et al. (2021) conducted a scoping review of 29 peer-reviewed journal articles to explore the barriers faced by young adults with developmental disabilities (DDs) in accessing and utilizing digital technology, as well as their transition needs in education, daily living, community integration, and employment. The study identified barriers such as affordability, availability, infrastructure, design, lack of alignment with individual needs, limited access to community activities, low literacy levels, and the need for accommodations. McMohan et al. (2023; 2013) successfully trained such individuals to use a mobile device with the Red Laser application to identify potential food allergens. The participants maintained their health, fitness, and wellness skills even six weeks later. In another study, McMohan et al. (2015) explored the use of location-based augmented reality navigation, comparing Google Maps and paper maps as aids for navigation in individuals with DDs. The results showed that participants were more successful in navigating to unknown business locations in a city using augmented reality compared to Google Maps and a paper map.

Several studies have focused on examining a modified or condensed version of functional digital literacy (DL) skills suitable for PIDs. These studies have specifically looked at basic skills such as sending and receiving email messages, organizing social bookmarking, accessing useful websites for downloading, revising, and uploading documents. The research has been conducted on various devices including Windows desktop computers, laptops, and iPad tablets (Cihak et al., 2015a; 2015b). In order to enhance the life skills and independence of students with moderate/severe ID and/or autism spectrum disorders, integrating mobile technology with instructional practices has been recommended. This involves providing direct support and customization to meet the specific needs of these students (Ayres, Mechling, & Sansosti, 2013). It is crucial to incorporate DL skills into the curriculum for PIDs to equip them with the ability to navigate online risks and safely handle potential dangers encountered in virtual settings (Holzman & Thompson, 2023).

DL can be a valuable tool for PIDs. It can support their skill development, enhance their communication and social interaction abilities. However, they face specific challenges when it comes to accessing and using digital technologies. They require appropriate support and training to ensure they have the necessary skills and knowledge to use technology

effectively and safely as responsible digital citizens. Regarding the effects of serious games on PIDs or autism spectrum disorders (ASD), a review of 54 studies demonstrated that the majority of these games had a positive impact. They were found to be particularly effective in improving social and communication skills, rather than conceptual and cognitive skills (Tsikinas & Xinogalos, 2019). Individuals with autism encounter difficulties with fine motor skills, making it challenging for them to use traditional keyboards or mice. They required adaptive input devices such as touch screens, alternative keyboards, visual aids, or other forms of assistive technology to support their learning and communication. Visual schedules or social stories can be beneficial in helping them understand and navigate digital tools and online environments. Overall, a personalized approach that considers the unique needs and strengths of each individual with autism is crucial for promoting DL and maximizing the benefits of technology (Lancioni & Singh, 2014).

As inclusive post-secondary education for students with ID becomes more prevalent in colleges and universities, there is a growing emphasis on academic enrichment, socialization, independent living skills, integrated work experiences, and career skills. Consequently, there is an increasing need to integrate digital skills into their education to enable them to effectively use various technology devices such as computers, tablets, smartphones, and pads for various purposes (Baxter & Reeves, 2022; Conley et al. 2019). In addition, Keeley & Bernasconi (2023) emphasized the importance of incorporating fun and practical content in DL training for individuals with multiple disabilities.

While there is confusion about the definition of**learning disabilities (LD)** between British and American versions, studies have focused on the television viewing habits and preferences of individuals with LD. The Talking Mats interview, which is a visual communication tool that uses symbols and pictures to help people with communication difficulties express their thoughts and feelings, has been used with individuals with aphasia, learning disabilities, dementia, and autism. Reviewing the video recordings of these interviews revealed areas of difficulty, such as the time duration of the interview, the tangibility of symbols, and the currency of vocabulary. This information helped to develop a tool that is fit for purpose (Bunning et al., 2017; Ryan, 1988). However, little is known about the DL skills of individuals with LD. Research findings indicate that 74.5% of PWDs have very low to low DL levels, while 8.5% are on average and 17% are highly digitally literate. Adults with LD have lower mean DL scores than adults in the general population. The use of DL skills at home or work adds to the variance explained in DL skills. These findings have implications for adult educators and policymakers (Patterson, 2022). In this age of increasing digitization, teachers can improve the attention and academic performance of all students with ADHD by incorporating targeted environmental, organizational, instructional techniques, and tech apps into their everyday instructional/classroom management practices (Barnett, 2017).

Individuals who are **deaf or hard of hearing (DHH)** have been significantly impacted by the digital revolution (Kritzer & Smith, 2020). DHH individuals have embraced various forms of electronic communication in their social and professional lives. This includes using Short Message Services (SMS) for personal interactions, telephone typewriters (TTY) or voice/TTY relay services for longer communications, fax for business and social contacts, and engaging in activities such as email, web browsing, accessing chat rooms, word processing, games, and studying (Power, Power, & Horstmanshof, 2006). While there are several DL resources available for educational purposes, none of them specifically cater to the needs of DHH learners. This highlights a gap in Deaf education where technology resources are not aligned to meet the requirements of DHH individuals.

Research indicates the importance of DL training for DHH students as well as their teachers. However, teachers of DHH students often rely on traditional methods when designing and delivering academic content-based learning activities. There is a lack of guidelines or frameworks for software developers or designers to create accessible resources. As a result, strategies need to be invented or adapted to effectively reach these learners. Consequently, the potential benefits that technology offers in terms of accessible communication solutions for DHH individuals are not fully realized (Flórez-Aristizábal et al., 2019). Various technological tools have proven useful for DHH individuals in terms of communication and access to information. These include electronic books, high-quality illustrated digital stories or websites with user-friendly closed captioning or subtitles for videos, text-based communication tools, and visual cues and alerts for notifications. These tools also serve as therapy aids for speech, language, and literacy development among DHH individuals (Alshawabkeh, Woolsey, & Kharbat, 2021; DeForte et al., 2020; Harris, 2015; Luft, Bonello, & Zirzow, 2009).

Measures of Digital Literacy

Enhancing DL skills in PWDs can create new opportunities, promote independence, and improve their QOL. Despite the growing recognition of the importance of DL in PWDs, there is a lack of validated measurement tools specifically designed to assess their levels of DL. There is a notable absence of basic-level items that cover essential DL skills such as connecting to a WiFi network, conducting searches on Google.com, using a mobile browser, accessing information, managing browser tabs, navigating social media, bookmarking web pages, clearing browser cache and cookies, engaging in chat conversations, managing messages, recording audio messages, and reporting/blocking users. The necessity, rationale, and justification for implementing DL measures become apparent when considering initiatives for ICT literacy or developing curricula tailored for PWDs (Chetty et al., 2018).

Most of the limited number of assessment tools available for measuring DL target college students, teachers, employers, and employees. These tools often utilize simulated situations, multiple-choice items, or right/wrong answers. It's important to note that measuring digital skills or competencies is distinct from measuring DL itself. Some examples of psychometrically sound and reliable DL measurement tools include the Digital Literacy Scale (DLS; Amin, Malik, & Akkaya, 2021) based on Chen's (2015) theory, the Digital Literacy Assessment Test (DLAT; Bansal & Mishra, 2021), the Internet Literacy Scale (ILS; Ma et al., 2023), the Digital Literacy Scale (DLS; Bayrakci & Narmanlioğlu, 2021; Park, 2022), and the New-Digital Literacy Scale (N-DLS; Reddy et al., 2023).

Studies have focused on measuring DL in specific populations. For example, Greene, Seung, and Copeland (2014) assessed DL components among college students, Sivrikaya (2020) examined DL levels among students in sports science using a 17-item Digital Literacy Scale (DLS; Ng, 2012). Baro, Obaro, and Aduba (2019) attempted to assess DL skills among library and information professionals. A systematic review on the measurement of DL (Oh et al. 2021) and the eHealth Literacy Scale (eHEALS; Norman & Skinner, 2006) is available for measuring DL among older adults. There are also specialized measures available for specific contexts, such as web-oriented DL measurement tools (Hargittai, 2005; Hargittai, 2009) or instruments that capture digital training experiences using graphic questionnaires (Macevičiūtė,

Wilson, & Manžuch, 2019). There is a lack of DL measurement tools specifically designed for PWDs.

Existing literature highlights this gap in research (White, Pavlovic, & Poed, 2020; Yustika & Iswati, 2020; Covello & Lei, 2010). Further development and validation of DL measurement tools tailored to the unique needs and challenges of PWDs are needed, whether it is for enabling individual or collective institutional decisions, or for framing a curriculum for learning. The validity, reliability, feasibility, context, utility, fairness, consistency, and precision of the instrument are important. The choice of targeted group viz.., children, teens, adults, or the aged, gender, socio-economic and health status, occupation (teachers, doctors, architects, sports persons, labor markets, or others) is also important (Bejaković & Mrnjavac, 2020; Garcia-Martin & Garcia-Sanchez, 2017). The measurement of DL as an essential life in research scholars of Law School is also available (Singh, 2018; Pratap & Singh, 2018). Other populations addressed by studies include school students (Kulkarni & Ramesha, 2021; Lazonder et al. 2020), and emergent literacy skills alongside conventional literacy skills in young children using e-books and digital games (Neumann, Finger, & Neumann, 2017). The problems reported were delays in internet connectivity, difficulties in finding relevant information, high cost of access, irregular power supply, too long to view/download pages, and slow access speed. The reported purposes of for using the internet by the respondents were to gather information, prepare class notes, for entertainment, solve question papers, and generate online question bank

Digital Literacy Empowerment Programs (DLEPs)

DLEPs are initiatives that provide individuals with the skills and knowledge they need to navigate and use digital technologies effectively. These programs usually focus on teaching fundamental computer skills, internet use, online safety and digital communication. These programs aim to close the digital divide and allow people to fully participate in the digital space. DLEP programs, provided by educational institutions, NGOs, and government agencies, often include training workshops and online courses, as well as resources to help learners develop their digital skills. Vulnerable groups in society that have benefitted from DLEPs include seniors/older adults; low-income individuals; immigrants; women from low socio-economic backgrounds; the marginalized and refugees; PWDs; people with physical or mental disabilities; and people living in rural or remote areas who lack access to digital technologies because of infrastructure constraints (Njenga, 2018; Bühler & Pelka, 2014; Lee, 2014). **The National Digital Literacy Mission (NDLM)** initiated by the Government of India and launched in August, 2014, targets key village-level workers into digitally literate person. Pallampara village, near Thiruvananthapuram city in Kerala is recorded as India's first fully digital literate panchayat (Gahlot & Gahlot, 2020; Babu, Kalaivani, & Saileela, 2019; Joseph, Kar, & Ilavarasan, 2017; Rajeev et al. 2018).

COVID-19 has had a significant impact on the digital participation and inclusion of PWDs in society. The problems were exacerbated by their isolation and poor living conditions during the pandemic (Chadwick et al. 2022). Software developers needed training to incorporate the necessary design features, interface and structure in relation to special educational needs (Hobbs & Coiro, 2019; Williams, 2006). Their carers and parents needed training to foster DL skills in their wards (Promrub & Sranratana, 2022). They needed navigation indicators and contextual aids, simplification of screen pages (graphically and textually) or game features, the predominant use of video based content, and the use of individual

interviews (Sauve et al. 2023; Seok & DaCosta, 2017) even during adverse times such as the Covid-19 pandemic (Karagul, Seker, & Aykut, 2021; Saribanon et al. 2020).

There are various formal or standardized DL empowerment programs that are often initiated by non-profit organizations. Some examples include the Digital Literacy Corps (Clark & Visser, 2011), Microsoft Digital Literacy (Kusumo, Subali, & Sunarto, 2022), Google Digital Garage (Jaison, 2020), Digital Promise, and TechSoup (Mallery, 2013). These programs offer courses on basic computer skills, internet safety, digital citizenship, digital marketing, data analytics, and other digital skills. Additionally, Microsoft's Disability Answer Desk provides technical support to PWDs who use Microsoft products, WebAIM's Training offers online training courses on web accessibility for PWDs, and The National Federation of the Blind's Access Technology Institute Program provides training on assistive technology for people who are blind or visually impaired. The American Foundation for the Blind's eLearning Center Program is another program that offers training on assistive technology for PWDs (Darvishy, Eröcal, & Manning, 2019).

Many DL programs that focus on PIDs, including Project UNITE, The Arc's Tech Toolbox Program, The National Center on Disability and Access to Education Program, and The Digital Literacy Alliance Program. These programs typically cover topics like basic computer skills, internet safety, and social media. They use various technologies such as online courses, webinars, email, and social media to teach about accessing educational technology, AT, instructional materials, universal design for learning, and online communication. Several independent studies and projects have attempted to evaluate the impact of short or long-term DL initiatives on different segments of the population. Martin & Grudziecki (2006) undertook a DigEuLit Project to define and develop a framework and tools to measure DL in educational settings.

Some studies in Pre-Service Teacher Education focus on addressing the challenges of integrating technology into teaching while providing effective strategies for transforming education. Key questions explored include the best practices for teaching digital literacy to teachers, where to start, what topics to cover in K-12 education, and how to adequately prepare teachers to achieve their goals (Keengwe, Onchwari, & Hucks, 2013).

One approach is to incorporate technology tools and resources into lesson plans to enhance students' digital skills and literacy development. This includes providing authentic real-world activities that allow students to apply their digital literacy skills in meaningful ways. Teachers also teach students how to critically evaluate digital information, promote collaborative projects and online discussions to foster digital communication skills, and encourage responsible and ethical use of technology.

In addition, teachers can teach students how to create and interpret various forms of digital media, tailor instruction to meet individual students' needs and interests, and provide continuous support and training for teachers to stay updated on the latest digital tools and teaching methods. Hobbs (2011) has demonstrated how media literacy can be incorporated into the secondary classroom, offering practical tools for fostering critical thinking, collaboration, and communication skills.

Individual Digital Learning Environment Plans (DLEPs) have shown positive impacts on performance by utilizing digital tools such as podcasts, blogs, and wikis (Mohammadyari & Singh, 2015). Other research by Kaeophanuek, Na-Songkhla, and Nilsook (2018) explores alternative methods for developing digital literacy among information sciences students

through self-assessment and in-depth interviews about teaching environments, problems, and obstacles.

Inclusive education for PWDs requires a reflection on their digital lives. Does disability limit their access to ICT? What factors affect their use and experience of ICT? What is the minimum ICT skills or abilities that need to be developed? How can PWDs remain secure in the digital space? Research on digital technologies vis-a-vis PWDs remains largely unexplored. If any accounts exist, they are based on the views of parents, caregivers, and teachers rather than the PWDs themselves. Annual Social Surveys have shown a continuous increase in ICT usage among PWDs in some countries, particularly after the turn-of-the-century. The dualism of ‘normal-disabled’ and ‘disabled-abled’ is to be rejected to strongly favour promoting DL for PWDs (Ozman, 2019; Lissitsa & Madar, 2018).

For PWDs, it has to be ensured that all digital materials used in teaching are accessible, such as screen readers, magnifiers, speech-to-text software, closed captions, and alt text for images. PWDs have different learning styles and abilities. Therefore, the use of a variety of teaching methods, such as visual aids, hands-on activities, and group work, to accommodate different learning needs is recommended. A supportive and inclusive learning environment that encourages participation and engagement from all learners by encouraging collaboration and peer support is suggested. Provision for assistive technology tools and software to help PWDs access and use digital resources. Encourage self-advocacy in learners with disabilities to advocate for themselves and their needs. Teach them how to communicate their needs effectively and seek out resources and support. Overall, teaching DL to PWDs requires a flexible and inclusive approach that takes into account the unique needs of each learner (Ortlieb, Cheek & Semingson, 2018; Ortlieb & Cheek. 2013). Based on six case studies, the authors advocate against dualism like “normal-deviant” or “disabled-abled.” by interpreting the cases from a social practice perspective before advocating fervently in favor of promoting DL for PWDs (Ozman, 2019). Baek and Aguilar (2022) examined the learning analytics literature over the past ten years (2011-2020). Their results showed that only 33% of articles they retrieved focused on PWD and 67% of articles retrieved engaged with PWDs tangentially on several themes: detecting difficulties, early intervention, promoting learning, addressing accessibility issues and challenges, and discussing ethics and privacy concerns.

Ethical Issues of Digital Literacy in PWDs

The ethical concerns surrounding DL for PWDs include the affordability and availability of digital resources, the responsibility of content creators and platform providers to ensure accessibility, and safeguarding their digital rights. PWDs are vulnerable to online threats, cyberbullying, theft, and harassment, necessitating protection of their personal information and devices. Informed consent, adherence to the law, overcoming barriers to access digital content and services, privacy and data protection, equal participation in the digital economy, and freedom of expression are crucial for PWDs in the face of advancing Internet and Communication Technology (ICT) and the Internet of Things (IoT). The rise in cybercrimes and fraudulent activities like cyber-terrorism, cyber-bullying, hacking, phishing, and spamming adds to these concerns (Peng & Yu, 2022; Joamets & Chochia, 2021).

Future Directions

In preparing future preschool educators, it is essential to strengthen the DL component in areas such as interactive didactic games, animation and programming basics, and network technologies, which are increasingly necessary (Anisimova, 2020). The educational system needs to introduce new learning models that incorporate modern innovative technologies and DL methods (Liu et al., 2020). In the future, there are several potential directions for DL development for PWDs. Inclusive design incorporating screen reader compatibility, smart boards, keyboard navigation, and alternative input methods is essential. Advances in ATs will continue to enhance DL for PWDs through speech recognition software, eye-tracking devices, and other tools that facilitate their access to digital content. DL programs will likely become more personalized to cater to their specific needs and abilities. Adaptive learning platforms and individualized instruction will help them acquire digital skills at their own pace and in ways that suit their unique learning styles. Online platforms and communities will play a crucial role in fostering collaboration and peer support among them. Governments and organizations will continue to recognize the importance of digital inclusion for PWDs and implement policies to promote accessibility and equal opportunities in the digital realm (Buckingham, 2015). Advocacy efforts will raise awareness about the digital divide and work towards bridging it for PWDs. The future of DL for PWDs holds great potential for increased accessibility, inclusive personalized learning, collaboration, and policy advancements (Sa et al., 2021). Addressing these limitations requires a comprehensive approach that considers accessibility, technology access, personalized learning, content diversity, and robust support systems. By addressing these challenges, DL programs can become more inclusive and effective for PWDs.

Summary

In sum, this empirical review highlights DL as an essential everyday skill for individuals, regardless of disabilities, to effectively utilize digital technologies for tasks like information retrieval, evaluation, creation, and communication. When combined with assistive technologies, DL plays a crucial role in enhancing learning experiences and overall QOL. Although research on DL in PWDs has increased in recent years, there is an uneven distribution of studies. This leaves opportunities for future research to focus on areas such as measuring and training DL for both teachers and such students. Ultimately, there is a call to promote DL among PWDs to bridge the digital divide and empower them to fully participate in today's digital society.

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