The Evolution of Assistive Technology:
Advancing Access and Equity – Then, Now, and Next

Increasing Competitive, Integrated Employment
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Introduction

Assistive Technology is defined as a piece of equipment or a system that is used to increase, enhance, or maintain the functional capabilities of a person with a disability. An individual can utilize a piece of equipment for an array of activities from using it on the job to perform tasks independently, utilizing a device to live in the community independently or to re-connect to a meaningful hobby.[1] The *Technology-Related Assistance Act of 1988* (Tech Act) was initially passed to provide funding to states to conduct needs assessments and implement response systems that focused on consumer needs identified through the Association of Assistive Technology (AT) Act Programs (2018). The law was reauthorized in 2004 by converting funding from a competitive grant program to a formula grant program for State AT programs (Section 4 Formula Grantees), and Protection and Advocacy AT Programs (Section 5) Formula Grantees. The reauthorization in 2004 resulted in a key shift to place individuals with disabilities at the forefront of service planning by helping them identify, select, and utilize AT devices of their choice to maximize independent living in the community and to help connect to opportunities for competitive, integrated employment.

During this same time period, the digital age advanced quickly with the invention of smart tools, marketed to the masses, bringing forth potential innovative accommodation tools to add to assistive technology options. However, people with disabilities did not have equitable access to these new off the shelf technology devices due to barriers of cost and a lack of implementation tools. In addition, there was a lack of capacity to train support providers to assist with daily living to support more independence at home, school, and overall community integration. People with disabilities continue to represent the group with the least amount of access to technology devices and internet access across all other categories of people by age, race, gender, income, and nationality.[2]

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[1]   Center for Assistive Technology Act Data Assistance (CATADA). https://catada.info/
[2]   GSMA. (2020, December). The Mobile Disability Gap Report.
https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/12/GSMA_Mobile-Disability-Gap-Report-2020_32pg_WEB.pdf

In 2022, the Congress reauthorized the Assistive Technology Act through legislation titled *The 21st Century Assistive Technology Act*. This legislation updated and modernized the AT Act and went into effect during June 2023. With each update to the Assistive Technology Act, the spirit of the ADA lives on to ensure individuals with disabilities are given the same opportunities to participate in and benefit from the goods and services offered.

The Past: What Assistive Technology Looked Like for People with Disabilities Prior to the 20th Century

The first recorded history of Assistive Technology began with specialized equipment targeting specific barriers for people with disabilities. During the 1800s, both Braille and hearing aids were invented.[3] The 1900s saw advances in both these technologies, when hearing aids became smaller making them easier to use, and with the invention of the portable Perkins Braille Typewriter. The 1900s was also a time when an explosion of new assistive technology inventions were brought to market such as talking books played on phonographs, the first electronic speech synthesizer, made by AT & T, the Sip and Puff Wheelchair, the Kurzweil Reading Machine (using scanning technology that allowed books to be read aloud), and the Adaptive Firmware Card (allowing individuals with limited mobility or control to use a keyboard).

During the late 1900s, the nation continued to see advancements and inventions to increase accessibility. New devices were developed that helped people to communicate solely with eye movement, computer text-to-speech programs were incorporated so people with disabilities could access written materials, and Frequency Modulated (FM) Systems emerged to support those with hearing loss for use in noisy business and social settings.

The 2000s brought updates to existing assistive technology tools and the acceleration of a broad range of smart devices were released into the market. The Eye-mask System was enhanced to help people with paralysis and Cerebral Palsy to interact with an on-screen keyboard to translate words into spoken text. And, cochlear implants were updated to stimulate the auditory nerve to enable people with severe hearing loss to hear speech sounds.

In addition, SMART Tables, integrating touch technology surfaces, were invented to support students with disabilities who experience motor challenges to collaborate with peers which made classrooms more inclusive. The DEKA Robotic Arm, a lightweight and extremely precise device helping with grip and pressure, was designed to help injured war veterans who lost limbs. Desktop and laptop computers were upgraded to include screen readers and screen magnification. Smart Tablets were released by Apple, Microsoft and Google spurring competition and invention until all three included accessibility features across all devices on the market.

During the 1970s, businesses with international offices utilized online video meetings. In the early 2000s, this feature became widely available to Internet users with free tools such as Skype and iChat. Starting in early 2020, the use of video conferencing skyrocketed in usage due to the

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[3] Disability Experts of Florida. (2020, March). Assistive Devices for Disability: Past, Present, and Future Blog. https://www.disabilityexpertsfl.com/blog/assistive-devices-for-disability-past-present-and-future

COVID-19 pandemic with social distancing measures being implemented resulting in communities and industries relying on virtual contact as a means to connect with each other.

The Present: How ACL Provides Support to Foster Technology Inclusion for People with Disabilities and the Evolution of More Innovative Assistive Technology Tools

Role of ACL to Support Assistive Technology Centers

The State Grant for Assistive Technology Program funded by the Administration for Community Living provides one grant to each state, the District of Columbia, Puerto Rico, and the outlying areas such as American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the United States Virgin Islands. Funding varies and is structured mostly by the population of each state and the surrounding areas. In addition, other factors include knowing who will lead and provide services to consumers with disabilities, and how to address ongoing systemic challenges that people experience in the community. These variables guide the structure of the state program ranging from a centralized, decentralized, or a hybrid model for service delivery.

Commonly referred to as Assistive Technology (AT) Centers, AT Centers have been utilized by individuals with disabilities ranging from young children, older students in high school, and adults with disabilities living and working in their community.[4] Families of people with disabilities are also able to utilize services that AT Centers provide when in need of vehicle modifications to transport loved ones with disabilities to everyday activities, including employment. AT Centers are pivotal to helping people with disabilities and families by providing tools and support for full integration in the community.

AT Centers provide opportunities for people with disabilities to test devices which enables an individual to choose the best assistive technology device to help them better connect with others, be more active in their community, re-connect to passions and hobbies, learn new skills, go to work, and be more connected with current events.

AT Centers also support people to acquire the necessary vehicle modifications or purchase modified vehicles. Many individuals with disabilities must rely on public transportation or other services such as Uber or Lyft which are often more costly and unreliable. The unintended consequences of having to rely on public transportation or paid transportation can be a significant barrier to a person with a disability seeking to obtain and maintain a job. A modified vehicle can allow for sufficient transportation needed for doctor's appointments, social activities, and to get to and from work. Currently, more advanced technological advancements are being made through autonomous vehicles which would create greater opportunities for people with disabilities to increase independence.

In addition to AT Centers, grants, and private funding are supporting collaborative projects across the United States, in schools and adult support service agencies, resulting in current data,

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4   Association of Assistive Technology Act Programs. (2022). Small Federal Investments – Large Benefits in Return. https://at3center.net/wp-content/uploads/publications/2022-atap-roi-report.pdf

evaluation and goal setting models, innovative new apps, and the training and hire of people with disabilities as trainers of technology.

Evolution of More Innovative Assistive Technology Tools

The evolution of improving assistive technology through more innovation to support people with disabilities has increased access in classrooms, employment settings and communities. Historical access barriers are being removed through a combination of innovative devices and off-the-shelf tools marketed to the general public. Off the shelf technology such as smart phones and tablets, smart watches, ring doorbells, and home control systems have increasingly begun to serve as accommodation tools to overcome longstanding barriers for people with disabilities. Below are some key examples:

- Smart phones and tablets, built with accessibility features, allow access to mobile tracking, organizing, entertainment, connection, education, travel, safety, and a plethora of other conveniences.

- With screen readers and voice to text options built in, these tools can access content for a broader set of needs and preferences, like voice or video messaging options in addition to text messaging, visual or written task lists, numerous reminder alarms for appointments and medication, phone and video calls with family and friends, virtual telehealth appointments, and attendance in online classes.

- Video messaging gives access to leaving messages in American Sign Language for people who are deaf, or in visual content for people who do not speak, read, or write due to a cognitive disability.

- Voice to text allows a person with dyslexia or other challenges to send text and email. Voice commands also allow someone to manage device menus, and to navigate to and within apps.

- Apps for visual tracking of budgets allow for concrete connection of dollars, earning, spending, and saving.

- Ring doorbells enable someone to see who is on the other side of their door, which addresses home safety while living independently in the community.

- Smart watches track a myriad of health issues that can provide warning alerts that require attention.

- Echo, Alexa, Nest and Siri are all voice to command systems that can open or lock the doors of one's home, open and close blinds, set the temperature of a space, navigate entertainment to a channel, show, or music, accommodating people with limited mobility and other disabilities.

The Future: What is Artificial Intelligence?

Artificial Intelligence (AI) has gained a lot of attention lately on what is possible for the future. In short, AI means a machine-based system that can, for a given set of human-defined objectives,

make predictions, recommendations or decisions influencing real or virtual environments.[5] The Biden-Harris Administration recognizes the importance of access as it relates to the emergence of AI resources. A leading current goal is to get a better understanding of the elements of AI and to ensure equity in its rollout that is inclusive of being aware of the impact on people with disabilities. The White House, Congress, and federal agencies have begun tackling this challenge and released resources:

- [Fact Sheet](#) (5/23/23) that outlines the steps the White House is taking to advance Artificial Intelligence in a responsible, strategic manner while protecting individual right and safety.

- Updated roadmap, *[Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem](#)* to guide the focus and expansion of federal investments in Artificial Intelligence research and development (AI R&D).

- A newly developed report, *[Artificial Intelligence (AI), and the Future of Teaching and Learning: Insights and Recommendations](#)*, that entails the risks and opportunities associated with AI in the education sector. It addresses the elements of AI in the educational setting such as learning, teaching, researching and assessment.

- The Equal Employment Opportunity Commission's [Report](#) clarifies how AI should be used in employment selection procedures under Title VII of the Civil Rights Act of 1964.

The Impact of Artificial Intelligence as it Pertains to People with Disabilities

Historically, individuals with disabilities have significantly lower access to smart technology devices and the internet access needed to fully utilize them: only 26% of the population of people with disabilities compared to 44% of the population without disabilities.[6] This exacerbates a growing divide to understanding and resources, especially in how to utilize forms of AI to connect to the community and to further independence. This is especially true for communities of color who lack financial stability and for individuals in rural areas that are disconnected from many services, geographically.

As AI continues to rapidly expand to influence assistive technology and the broader community, below briefly outlines how the emergence of AI can present opportunities or challenges for people with disabilities:

Opportunities

- **Communication Aids**: AI-powered speech recognition and text-to-speech systems can assist individuals with speech disabilities in expressing themselves more effectively.

- **Personalized Learning**: AI can adapt educational materials to match the learning pace and style of a person with a disability, making learning more accessible and engaging.

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[5]   National Artificial Intelligence Act of 2020, 15 U.S.C. § 9411. (2020). https://www.congress.gov/bill/116th-congress/house-bill/6216

[6]   Pew Research Center, Survey of US Adults (2021, September). Americans with Disabilities Less Likely than those without to Own Some Digital Devices. https://www.pewresearch.org/short-reads/2021/09/10/americans-with-disabilities-less-likely-than-those-without-to-own-some-digital-devices/

- **Augmentative and Alternative Communication (AAC)**: AI can enhance AAC devices, helping people with speech or language impairments communicate more fluently.

- **Visual and Auditory Assistance**: AI can provide audio descriptions for the visually impaired, convert text to Braille, or offer real-time object recognition to help navigate the environment.

- **Predictive Text and Autocorrect**: AI features can support individuals with motor disabilities who might have difficulty typing.

- **Social Interaction**: AI can assist with social skills training by providing feedback and guidance during interactions.

- **Job Accommodations**: AI-powered tools can offer workplace accommodations, such as speech to text software for individuals with typing difficulties.

- **Emotional Support**: AI-drive chatbots and virtual companions can offer emotional support and companionship to help minimize social isolation.

- **Accessible Content**: AI can generate alternative formats of content, such as captions, subtitles, and audio descriptions, making media more accessible to those with sensory disabilities.

- **Cognitive Support**: AI can provide reminders for tasks and appointments, helping individuals with cognitive impairments manage their daily routines.

Challenges

- **Labor Impact**: AI may diminish job opportunities for people with disabilities through increased automation in the service industry, a sector that is highest for people with disabilities.

- **Human Resources**: AI used in the automation of processing resumes by employers may be biased against a group, including people with disabilities.

- **Privacy**: AI may not safeguard user privacy when using its tools.

- **Lack of Training**: AI application and knowledge transfer is difficult for the Direct Support Professional (DSP) workforce due to lack of training on how it can be integrated within the home, community, and workplace. Additionally, the national shortage of DSPs also presents another barrier in helping people with disabilities adapt to and learn the skills of new AI applications.

Conclusion

The landscape of Assistive Technology for people with disabilities has evolved significantly over the last three decades. Now with emerging technologies of Artificial Intelligence, there may be a new opportunity for people with disabilities to increase access. As before, in order to ensure equity and inclusion, people with disabilities need access to evolving technology tools in order to live and work alongside the rest of the population. To do this, training opportunities for families, teachers, and support staff must increase. Assistive technology, which now includes touch tablets, smart devices, home systems, and Virtual Reality (VR), along with the growing market in AI, needs to become a vital part of planning through the person-centered approach.

In order to participate in the ongoing discussions about use and invention of tools, people with disabilities must be at the table to share their feedback of its utility when using these tools. To achieve this, the integration of technology must be embedded in the requirements of services and in the Strategic Plan of service providers across schools and agencies. In addition, the issue of ownership must be resolved so that a user can maintain equipment and technology tools as they transition more seamlessly from one service system or provider to the next.

In order to ensure access and equity as AT and AI increasingly merge together, people with disabilities must have an awareness of this technological evolution and be engaged through their feedback to ensure continuous inclusion. To do this, we must ensure the voices of individuals with disabilities are part of the design solution with the development of new assistive technology tools.