



A Second Look at What High School Students Who are Blind Should Know About Technology

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Abstract

This article presents an overview of mainstream and assistive technology skills and tools to be mastered by high school students who are blind in preparation for postsecondary education. It is an update to an article written on this exact topic fifteen years ago. The recommendations focus entirely on what is necessary in today's high-tech society for high school learners who read and write braille competently (e.g., read braille tactually at a minimum rate of 30 words per minute). The number of recommendations from the original article in 2004 has more than doubled. There were only 14 recommendations in 2004. In 2018 there are more than 30 recommendations for students who are blind to relate to their use of assistive technology. The Certified Assistive Technology Instructional Specialist for People with Visual Impairments (CATIS) provides a Scope of Practice and Body of Knowledge that is sufficient for supporting the substantial growth in the assistive technology-related knowledge, skills, and tools recommended in this article.

Keywords

Assistive technology, blind, certification, education, visually impaired

Introduction

This article represents a “second look” at the issue of competence in the use of appropriate technology to be mastered by students who are blind and who may be enrolling in some type of postsecondary educational program. The first attempt was made fifteen years ago by Kapperman and Sticken (2004). Research prior to and after this first attempt occurred consistently shows that the vast majority of students who are visually impaired are not receiving the training they need with assistive technology (AT) (Abner and Lahm; Candela; Edwards and Lewis; Kapperman, et al.; Kelly, 2008, 2009, 2011, 2016). In order to remedy this most unfortunate situation, a new AT specialization for people who are visually impaired has been developed after several decades of effort (Augusto and Schroeder; Kelly, 2016). This specialized training leads to a credential in the use of AT that has been developed for use by individuals who are visually impaired. The Certified Assistive Technology Instructional Specialist for People with Visual Impairments (CATIS) is the new certification that was launched by the Academy for Certification of Vision Rehabilitation and Education Professionals (ACVREP) in 2016 (Kelly, 2016). The new CATIS certification has established competencies and standards in the area of AT training for people with visual impairments.

Thus, at this important juncture we are updating that first attempt by Kapperman and Sticken (2004) in direct response to the new CATIS competencies and the ongoing need for AT training among learners who are visually impaired. Since the first article was published in 2004, the AT arena has changed dramatically for braille-reading students.

Discussion

The skills and proficiencies that should be acquired by students who are blind prior to their high school graduation and enrollment in postsecondary education programs are described

below and outlined in Table 1. Also, Table 1 compares each of these skills and proficiencies to recommendations from Kapperman and Sticken (2004). There are significant alterations to the recommendations. Considerable progress has been made in the development of technology since the first attempt to summarize their needs was made. Table 1 shows that there were 14 skills or tools specifically identified in 2004 that students who are blind needed to acquire prior to high school graduation. Fifteen years later, this list has more than doubled to 35 essential skills or tools. It is likely that this list will continue to grow exponentially over time.

Table 1. Comparison of Prior and Current Recommendations for Essential Skills and Tools Related to the Use of Assistive Technology by High School Students Who are Blind.

Essential Skills and Tools	2004 <i>n = 14</i>	2018 <i>n = 35</i>
Amazon products and services (e.g., Alexa, Echo, and Tap)	No	Yes
Apps (i.e., accessible apps for portable devices)	No	Yes
Beacons	No	Yes
Braille embosser	Yes	No
Braille reading (reading braille tactually at a minimum of 30 words per minute)	No	Yes
Braille notetakers connected to a computer and monitor	Yes	Yes
Braille notetakers connected to a tablet and smart phone	No	Yes
Cloud-based storage	No	Yes
Configuration of technology	No	Yes
Dictionary and encyclopedia (standalone programs)	Yes	No
Dictionary and encyclopedia content available from online search engines and built into programs	No	Yes
Downloading and storing of ebooks (no format specified)	Yes	Yes
Downloading and storing of ebooks in multiple formats (e.g., audio, brf, DAISY, and EPUB)	No	Yes
Downloading and storing of music legally	Yes	Yes
Email program (skill with only one program is sufficient)	Yes	No

Essential Skills and Tools	2004 <i>n = 14</i>	2018 <i>n = 35</i>
Email programs (skill with multiple programs is necessary)	No	Yes
Exploration of emergent technology (e.g., 3D printing and haptic technologies)	No	Yes
Gestures for accessing Apple/iOS devices	No	Yes
Global Positioning System (GPS) and wayfinding accessible applications/devices	No	Yes
Google-based products (e.g., Google Chrome, Chromebooks, Drive, and Home)	No	Yes
Internet browser and search engine (skill with only one program is sufficient)	Yes	No
Internet browsers and search engines (skill with multiple programs is essential)	No	Yes
Keyboarding (touch typing a minimum of 50 words per minute)	Yes	Yes
Keystroke commands for both desktop and laptop computers	No	Yes
Keystroke commands for Apple	No	Yes
Keystroke commands for Windows	Yes	Yes
Maintenance of technology (e.g., installing updates and antivirus protection)	No	Yes
Microsoft programs (i.e., Word, PowerPoint, and Excel)	Yes	Yes
Optical Character Recognition (OCR) technology and supporting applications	Yes	Yes
Refreshable braille display connected to a computer and monitor	Yes	Yes
Refreshable braille display connected to a tablet and smart phone	No	Yes
Screen reading program (skill with only one program is sufficient)	Yes	No
Screen reading programs (skill with multiple programs is necessary)	No	Yes
Smart phones (e.g., Android and iPhone) and built-in accessibility features	No	Yes
Social and professional networking online platforms (e.g., Facebook and LinkedIn)	No	Yes
Talking book player	No	Yes
Third-party software setup and customization	No	Yes
Troubleshooting of technology	Yes	Yes
Voice-activated personal assistants (e.g., Cortana and Siri)	No	Yes
Video calling applications (e.g., FaceTime, Skype, and Zoom)	No	Yes

Summary of Current Recommendations

In addition to being able to read and write braille competently (e.g., reading braille tactually at a minimum rate of 30 words per minute), we recommend that the student use a standard keyboard and be able to touch type competently at the rate of at least 50 words per minute. Being able to use a standard keyboard is essential for the effective use of a computer.

We believe that among the many important areas of competence is being able to use screen reading software. We recommend that the student should have mastered the intricacies of at least two screen reading programs. For example, Job Access with Speech (JAWS) and NonVisual Desktop Access (NVDA). JAWS is the most widely used screen reader worldwide (WebAim). As a consequence, many programs have been in some fashion adapted for use with JAWS. There are many special scripts which have been written to enable JAWS to be used with a large assortment of commonly used software utilized by sighted individuals. For example, JAWS can be used very effectively in the study of foreign languages (Kapperman et al., 2017).

The mastery of at least one other screen reader such as NVDA is recommended. We believe that students who are blind and attend college should have at least one “backup” screen reader along with several other alternative pieces of hardware and software. Depending on one single, very vital piece of technology is not recommended. Having multiple methods of using technology to accomplish the same task is a recent development with these recommendations that is evident with many regularly used programs (e.g., email, internet browsers, and search engines). It is now common place in today’s society to have multiple email accounts and to use more than one search engine online.

Thus, it is recommended that the student should have mastered all keystroke commands to be able to function expertly using at least two screen reading programs. To facilitate this, for

example, the settings in NVDA can be set to use “JAWS” key stroke commands. Thus, the student need to master only one set of keystroke commands. In addition, the student should be well-acquainted with all major keystroke commands which are used in whichever version of the operating system is found on the student’s computer. This includes both Windows and Apple/iOS keystroke commands and gestures. Likewise, knowledge of both the desktop and laptop configuration of keystroke commands is important for flexibility in the use of various devices available to the student throughout their education and professional career.

The student should be competent in the use of several Microsoft programs including Word, Outlook, Excel, PowerPoint, and Skype. Skype is one example of a video conferencing application. A range of video calling applications are available such as Google Hangouts, Zoom, and FaceTime that can be used by a students who are blind to facilitate their academic and professional networks. In addition, the student should know how to use cloud-based storage such as Dropbox, iCloud, or OneDrive and the many additional Google-based products designed for information sharing among global communities.

Thus, the student should be competent in the many resources that the Internet can offer. Chief among these for a student who is blind is the seeking out, downloading, and using of books in multiple formats (e.g., audio, brf, DAISY, and EPUB) from such sources as Bookshare, the Library of Congress, and Learning Ally. An accessible talking book player is one of several tools that a student who is blind should be able to use to read these readily available materials.

Also, the student should be effective in sending and receiving email from a range of email service providers, seeking out information, downloading files, and making purchases online as well as taking advantage of the other wide range of benefits that the Internet offers for digital social networking (Kelly and Smith).

To reiterate as we described above, the student should be a competent reader and writer of braille. Thus, he or she should be competent in the use of refreshable braille displays and portable braille notetakers that are supported by screen reading programs. The use of a braille displays and portable braille notetakers alleviates the need for large amounts of hard copy braille which can result in difficulty with organization and storage.

Obtaining access to the printed word is one of the most challenging aspects of education for a student who is blind (Presley and D'Andrea). Thus, he or she should also have expertise in the use of accessible scanning applications and hardware that utilize the latest optical character recognition (OCR) technology to convert print documents into accessible digital formats. He or she will find this capability of vital importance given that not all printed information that he or she needs to read may be easily acquired through other means.

In the previous article which was written fifteen years ago, the use of a braille embosser, online dictionary, and online encyclopedia were all recommendations. We no longer recommend those items here. With the advances in technology and refreshable braille devices, we believe that a hard copy braille embosser need not be necessary. A similar situation exists for online dictionaries and encyclopedias that we believe need not be necessary as standalone applications. The internet has this information readily available through online search engines, for example.

The student should be competent in the use of a smart phone such as an iPhone or an Android and the accessibility features built into these smart phones. In addition to the many specially designed apps which can function on these devices, special attention should be paid to the use of accessible Global Positioning System (GPS) and wayfinding apps designed for use by individuals who are visually impaired.

The use of other wayfinding devices and emergent technology that exists in smart cities is important too. A talking handheld GPS system can be used for navigation within local communities and around the world. Beacons provide indoor and outdoor turn-by-turn directions as well as location descriptions that are designed specifically for people with visual impairments.

Equally as important to the smart cities technology is the smart home technology that is readily available. Voice-activated personal assistants such as Amazon's Alexa and Google Home are in high demand on today's market. For students who are blind, these devices can provide instant access to information, home appliances, music, products, and services.

The student should be proficient in configuring technology in order to be able to use it. This includes the ability to connect to peripheral devices as well as access points using technology such as Bluetooth, Wi-Fi, and Near Field Communication (NFC) (ACVREP, 2017). Built-in features and third-party software should be able to be setup and customized by the student. When it comes to refreshable braille displays and braille notetakers, for example, this means being able to connect them not only to computers and supporting screen reading applications but also to smart phones, tablets, and other forms of portable technology.

The competent user of access technology should have the capability of troubleshooting effectively. This set of knowledge includes a fundamental understanding of the technical aspects of operating systems and how to make needed alterations in settings. The ability to perform routine maintenance such as software updates and antivirus protection is an essential skill. Also, the individual needs to know how to find help by reading user documentation and working together with others. This includes contacting existing technical assistance agents who represent the various manufacturers of the pieces of hardware and software which populate the student's assortment of AT.

In addition to all of the skills involved in using existing technology, the student should have the ability to use emergent technology and to adapt with the technology as it continues to evolve. Exploration is a key component of this competency. The student's review of technology tools should occur whenever possible through opportunities such as public beta testing, online vendor training, and free trials (ACVREP, 2017).

Providing Students Who are Blind with the Necessary Assistive Technology Instruction

It is evident that there has been substantial growth in the scope of the assistive technology skills and tools recommended for high school students who are blind over the past fifteen years and the shortage of instructional expertise to support this growth is a longstanding problem in the field. The new certification in the area of assistive technology for people with visual impairments has an emphasis in instruction and has been developed to alleviate this problem. In fact, the letter "I" in CATIS stands for "Instruction". These newly certified individuals are instructional specialists in the area of assistive technology for persons with visual impairments. For the first time ever, there are individuals who have met national standards and qualifications in this area of instruction. Figure 1 overviews the instructional strategies from the CATIS Scope of Practice. In addition to the information about instructional skills provided in the CATIS Scope of Practice, there is a comprehensive list of 21 specific instructional skills outlined in the CATIS Body of Knowledge in the ACVREP CATIS Handbook (2017). These instructional strategies are used by CATIS to support the wide range of ever-growing assistive technology knowledge, skills, and tools now required of high school learners who are blind. In addition to the instructional domain there are similarly exhaustive lists of practice and knowledge skill sets in the assessment, configuration, and exploration domains. CATIS are required to master and demonstrate each of

these domains to become certified. The CATIS is an integral component of the effective instructional delivery of the recommended skills and tools outlined in this article.

CATIS Scope of Practice General Instructional Strategies

- Guides individuals to make appropriate, informed decisions on the most appropriate and efficient toolsets based on their abilities, needs and goals
- Applies learning styles and learning theory to suit the individual
- Creates a training plan specific to individual's abilities, goals and needs
- Instructs in integrating assistive technology, devices, hardware and software into daily activities that enhances daily life or the educational or work environment
- Instructs in multiple ways via hands-on experience or lecture, (best practices for children and adult principles)
- Instructs in home, classroom, other school environment, workplace or community
- Adjusts scope, structure and pace of instruction based upon learning styles and capacity for new information
- Adjusts scope, structure and pace of instruction based upon changes and advances in technology
- Instructs in planning, implementation, and record keeping for short-term and long-term instruction
- Instructs in local, regional and national assistive technology resources and teaches strategies for troubleshooting
- Provides resources for further learning

Fig. 1. Instructional Strategies from the ACVREP CATIS Scope of Practice.

Conclusions

The world has become an increasingly more complex environment to be negotiated and it requires much more highly developed expertise to be a success at that very daunting task. The challenges are even greater for those individuals who cannot see and who face the aforementioned longstanding challenge of the lack of AT training (Abner and Lahm; Candela; Edwards and Lewis; Kapperman, et al.; Kelly, 2008, 2009, 2011, 2016). However, the newly developed CATIS certification is designed to address these barriers to information for people

who are visually impaired. Furthermore, the recommendations that have been outlined are well-represented in the CATIS Scope of Practice and Body of Knowledge (ACVREP, 2017). These recommendations are intended to support learners who are blind in taking their place in the twenty-first century where skill in the use of a wide range of mainstream and assistive technology is paramount for success.

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