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Actual and Preferred Methods for Learning to Use Assistive Technology

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Abstract

This study investigated the preferred and actual methods for learning assistive technology (AT) by employed individuals who are blind or have low vision. Hands-on training was the preferred method for learning to use new AT, particularly among those who lost vision later in life. However, most participants considered self-training as their primary actual learning method. The findings indicate a need for more formal training opportunities and suggest a gap between this need and the availability of training by qualified professionals. The findings also suggest content to incorporate into formal training, including utilizing mobile apps, developing problem-solving skills, and locating and using training resources available online. AT trainers should emphasize to their students the ongoing, life-long learning needed to maintain and enhance AT skills and knowledge.

Keywords: assistive technology, training, blind, low vision, employment

Introduction

Assistive technology (AT) is critically important for employment and daily living for people who are blind or have low vision. Employment rates for people with blindness and low vision have historically been much lower than for people without disabilities (McDonnall & Sui, 2019). The current gap in employment rates between these groups is 28 percentage points (U.S. Census Bureau, 2022). Our world is becoming increasingly digitally dominated, if not digitally dependent. The same is true for most workplaces; a recent study found that 92% of jobs today require digital skills and that jobs requiring more digital skills earn more (Bergson-Shilcock et al., 2023). Digital skills are the ability to use digital devices, communication applications, and networks to access and manage information, and they include entry-level or basic skills (such as using email, word processing programs, and spreadsheets) and advanced or industry-specific skills (such as electronic medical records and AutoCAD) (Bergson-Shilcock et al., 2023; UNESCO, 2018). For people with blindness and low vision to obtain digital skills, AT skills are essential as AT allows them to access digital tools. Just as obtaining digital skills takes time, so does learning to utilize AT effectively. We currently have limited information about how people typically learn to use AT. Therefore, the purpose of this study was to investigate preferred and actual methods for learning AT by employed people who are blind or have low vision. We also evaluated relationships between age and age of onset with preferred learning methods and self-perceived skill level with actual learning methods.

Target Audience and Relevance

The target audiences for this paper are all professionals who work with individuals who are blind or have low vision to help them obtain skills that contribute to their employment. A primary audience within that group is professionals who help people learn to utilize AT, which

includes certified assistive technology instructional specialists (CATISs) and other AT instructors, teachers of students with visual impairments (TVIs), and certified vision rehabilitation therapists (CVRTs). We believe this study's findings are relevant to all blindness-field professionals because they provide novel information about how employed people who are blind or have low vision prefer to learn AT and actually did learn the AT they use at work. This information is relevant to one of their practice's purposes: to help prepare people with blindness and low vision for employment. In addition, our findings are relevant to manufacturers and vendors who want customers to learn to utilize their AT successfully.

Background

Although the extent of AT for individuals who are blind or have low vision has grown substantially in recent years, its adoption varies. Several theories have been proposed to explain the process of technology adoption and this topic has been widely studied (Koul & Eydgahi, 2017; Salahshour Rad et al., 2018). A few studies have focused specifically on AT adoption by people with blindness and low vision. Variability in adoption can be influenced by an individual's needs and the purpose of use, whether for school, work, or independent living (Turkstra et al., 2023). Practical factors such as affordability, usability, functionality, and efficiency have been associated with the likelihood of adopting an AT (Kim, 2021, 2022; Li et al., 2021; Moon et al., 2022). Another factor that may impact AT adoption is the learning curve associated with new AT, which can often be steep (Kim, 2022; McDonall & Steverson, 2023).

A limited amount of research has explored how individuals who are blind or have low vision learn to use AT or their preferences for learning AT. Most of the literature on how individuals who are blind or have low vision learn to use AT focuses on school-aged individuals, who often learn to use AT from TVIs, family, and peers (D'Andrea, 2012; Hewett et al., 2017;

Wong & Cohen, 2011). For example, TVIs may expose students to screen magnification, screen readers, speech-to-text, or other AT that makes schoolwork accessible. However, this AT training may be inconsistently delivered, inadequate, or inefficient (Wong & Cohen, 2011; Zhou et al., 2011). In addition, the number of AT skills considered necessary for high school students to succeed in college has increased significantly (Kelly & Kapperman, 2018). When formal training for AT is not readily available, this may necessitate informal training from family members or others who may have limited knowledge of AT (Kelly & Kapperman, 2018; Wong & Cohen, 2011). Some students also engage in self-training via built-in help options or trial and error to advance their proficiency (D'Andrea, 2012).

Little is known about how adults with blindness and low vision learn to use AT, even though AT needs change across the life course. A survey conducted by the American Foundation for the Blind (AFB) examined how participants initially learned to use AT and who taught them (Silverman et al., 2022). Out of 300 participants, vocational rehabilitation (VR) staff and TVIs were most frequently reported as the initial instructors for AT, at 43% and 42%, respectively. Other commonly reported AT instructors were staff at agencies for the blind (27.7%), AT company personnel (21.7%), and another blind or low vision individual (20.7%), while 11.3% of participants reported being self-taught (Silverman et al., 2022).

A study that investigated the replacement of traditional AT (e.g., screen readers, magnifiers, braille displays) with mainstream devices (e.g., smartphones, tablets) by people who are blind or have low vision found that learning methods differed between traditional AT and mainstream devices (Martiniello et al., 2022). Self-training and web-based resources were the two most frequently reported learning methods at 58% and 52% for traditional AT devices, 69% and 58% for smartphones, and 75% and 46% for tablets (Martiniello et al., 2022). Assistance

from other blind and low vision users was also a common way to learn AT, reported by 42% for traditional AT devices, 43% for smartphones, and 21% for tablets. A key difference was found in the share of users who received training from vision rehabilitation professionals at 42% for traditional AT devices compared to 7.5% for smartphones and 7% for tablets (Martiniello et al., 2022).

One qualitative study of AT in the workplace found that training methods vary, although the study sample consisted of only five participants (Wahidin et al., 2018). In this study, some AT users reported seeking basic training on AT from agencies that serve the blind and low vision population but then turned to self-training to advance their skillset, while other AT users relied on self-training from the outset (Wahidin et al., 2018). Another study, using a convenience sample of 20 older adults, found that these individuals were more likely to rely on family and friends (sighted and visually impaired) to learn AT and preferred in-person AT assistance (Kim, 2021). Older learners who are blind or have low vision perceived one-on-one training as more efficient, and desirable, than user manuals or similar resources (Piper et al., 2017). Research on AT use among older people, regardless of disability status, found the lack of availability or awareness of formal training from service providers to be a primary barrier to their use (Yusif et al., 2016). While a preference for in-person or formal training may be due to generational differences in technology use or comfort with technology, it may also potentially be associated with the age at which vision loss occurred.

The availability of user resources, such as podcasts, online videos and webinars, and online discussions, may contribute to the frequency of self-training as an option for learning AT. AT users perceived these resources as useful tools for improving their AT skills, learning about new AT, keeping their AT up-to-date, or solving compatibility issues (Silverman et al., 2022).

Another factor potentially contributing to self-training of AT is that some professionals tasked with teaching AT may not be well prepared. Many TVIs have deficits in knowledge about AT competencies and a majority lack confidence in teaching AT (Zhou et al., 2011, 2019) and vision professionals rated their AT-assistance skills in the medium range (ATiA, 2022). These limitations may be linked to the extensive amount, high cost, and rapid development of AT, making it difficult for service providers to attain expert-level proficiency in multiple technologies (D'Andrea, 2012). In addition, there is a shortage of qualified AT professionals (ATiA, 2022; Kelly & Tikkun, 2017; Parker, 2020). Although formal training may be lacking, there is a demand for hands-on, in-person training, particularly as a resource for increasing AT skills, as reported by approximately 25% of participants in an open-ended item in the AFB study (Silverman et al., 2022).

There is some evidence that AT learning methods may vary by age at vision loss. People who experienced vision loss after age 60 were more likely to rely on training from service providers for mainstream technologies (Martiniello et al., 2022). Older individuals with visual impairments who were already users of mainstream technology may more easily learn and adopt the accessibility features and third-party mobile applications to assist in their daily activities (Kim, 2021). Thus, proficiency with technology, rather than age or age at vision loss, may reduce learning curves for new AT.

To increase our knowledge about how employed adults with blindness and low vision learned to utilize their AT and their preferences for learning new AT, we investigated research questions 1-4 below. In addition, the fifth question represents an exploratory investigation, given that research has not been conducted regarding a relationship between AT learning method and skill level.

1. How do employed people prefer to learn to use new AT and updates to their existing AT?
2. Does preferred learning method differ based on age or age at vision loss?
3. How do people who are blind or have low vision learn to use their workplace AT?
4. What percentage of employed people with blindness and low vision received formal training to learn their AT?
5. Is primary learning method for a specific AT associated with perceived skill level for that AT?

Method

Data Source and Participants

Study data are from the second survey of a 5-year longitudinal study focused on the use of AT in the workplace. The study was determined to be exempt by the authors' university's Institutional Review Board for the Protection of Human Subjects and represents the perspectives of the authors. For inclusion in the longitudinal study, participants had to be age 21 or older, blind or have low vision, and employed. Data collection for the second survey occurred between May 2022 to August 2022. The sample for this study includes 315 participants who answered questions about their AT used on the job, preferred methods for learning new AT and updates to existing AT, and the actual learning methods for ATs. Participants rated their perceived skill level for particular ATs and provided their demographic information in the first survey of this study, and this data was combined with participant responses to the second survey for this study. Information about the first survey is available in existing publications (McDonnall et al., 2023a; McDonnall et al., 2023b).

Participants' ages ranged from 22 to 90, with a mean of 46.6 years (*SD* = 12.18). Most were female (61.6%), White (84.8%), blind or had minimal functional vision (81.0%), and had a

bachelor's degree or higher (81.9%). While most participants (97.5%, *n* = 307) were from the United States, a few (2.5%, *n* = 8) were from Canada. Participants represented 42 states plus the District of Columbia and four Canadian provinces. Table 1 provides additional participant demographic information.

[Insert Table 1 Here]

Participants selected the ATs they used on the job from a list of 29 AT. For this study, we included 10 of the most commonly used AT at work. Three of these devices were commonly used by participants who were legally blind with some functional vision or low vision (third-party screen magnifiers, built-in screen magnifiers, and electronic video magnifiers) and seven were commonly used by participants who were blind or legally blind with minimal functional vision (third-party screen readers, built-in screen readers, optical character recognition (OCR) apps, refreshable braille displays, OCR software and hardware, orientation and navigation apps, and braille notetaking devices).

Measures

Preferred Learning Methods

Participants were provided a list of eight preferred methods for learning to use new AT devices or software and asked to select their first, second, and third choices. The eight options were (a) having someone teach me (hands-on training), (b) reading online tutorials and/or user resources, (c) email or online listservs/user groups, (d) listening to recorded tutorials, (e) participating in a live webinar where I can ask questions, (f) reading the manual and trying it out on my own, (g) figuring it out by trial and error, and (h) using the built-in help features.

Participants identified their first, second, and third options for preferred learning methods for updates to their existing AT devices or software. Participants had the same eight choices from

the preferred learning methods with two additional choices: (a) reviewing update details through written, audio, or video releases from the vendor and (b) talking to my friends or colleagues about the updated features. For both preferred learning method variables, the authors collapsed the first-choice responses into three-category variables for chi-square analyses: (a) self, (b) resources, and (c) training. These 3-category variables for preferred learning methods for new AT and preferred learning methods for updates were further collapsed into two-category variables for the trend analyses: (a) training and (b) other.

Actual Learning Methods

Participants identified all the actual ways they learned to use each selected AT from a provided list. If they selected more than one method, they then identified which method they considered their primary learning method. The question to determine their primary AT was worded: "Of the methods you selected, which do you consider the primary way you learned to use _____ (the specific AT)?" The options provided to the participants were (a) in school (taught by TVI), (b) training provided through VR agency or agency for the blind, (c) vendor, (d) self-taught, (e) tutorials, (f) another person with blindness or low vision, and (g) other. An eighth category, "other training," was created from "other" write-in responses that mentioned training that did not fit an existing category.

We created a training variable to indicate type of training received. If a participant selected taught by a TVI, VR or agency training, vendor, or other training, this was classified as *received formal training*. If the participant indicated that another person with blindness or low vision taught them, this was classified as *received informal training*. If the participant did not report any of these, they were considered to not have received training.

Age and Age at Onset

Participants' ages were calculated based on their month and year of birth subtracted from the month and year of data collection. The authors then created an age category variable with five levels (i.e., 21-30, 31-40, 41-50, 51-60, and 61 or older). Participants reported their age when they first experienced serious difficulty seeing. From that information, the authors generated a 4-category age of onset of vision loss variable: pre-school (ages 0-4), K-12 (ages 5-18), post-school (ages 19-39), and age 40 or older.

Self-Perceived Skill Level

Participants rated their perceived skill level with each specific AT they used at work on a 10-point scale (1 = *beginner*, 10 = *advanced*) in the first survey. This variable was used for the analyses to answer research question 5. The first survey did not separate built-in screen readers and magnifiers but instead included a combined AT (built-in accessibility features on a computer). Therefore, we were unable to assess skill level by learning method for those two ATs.

Data Analysis

We used SAS 9.4 to conduct all analyses. Descriptive statistics (i.e., means, standard deviations, and frequencies) were used to determine participant demographics, learning preferences for new AT and updates to existing AT, actual methods to learn to use AT, and percentage who received formal training (research questions 1, 3, and 4). We used Chi-square analyses and the Cochran-Armitage trend test to investigate the relationship between preferred learning methods and participants' age and age at vision loss (research question 2). Analysis of variance (ANOVA) was used to investigate the relationship between participants' primary learning method for specific AT and perceived skill level (research question 5). Actual learning methods with less than 4 observations (skill ratings) in a category were not included in these analyses.

Results

To address research question 1, Figure 1 displays the methods participants preferred for learning to use new AT devices and software, including their first preferred method. Figure 2 displays participants' preferred methods for learning about new features or updates to AT they already use.

[Insert Figures 1 and 2 Here]

Participants preferred learning methods for new AT devices ($X^2(8, N = 315) = 1.36$, $p = .99$) or updates to existing AT ($X^2(8, N = 315) = 7.36$, $p = .50$) did not differ based on age. However, there were significant differences based on participants' age at vision loss (see Table 2 for Chi-square results). There appeared to be a trend for a preference for training as age of onset of vision loss increased, which was tested with the Cochran-Armitage trend test (Z statistic). As the age of vision loss onset increased, participant preference for training (compared to any other method) increased for new AT devices ($X^2(3, N = 315) = 15.94$, $p = .001$; $Z = -3.87$, $p < .0001$) and for updates to existing AT ($X^2(3, N = 315) = 22.48$, $p < .0001$; $Z = -4.58$, $p < .0001$).

[Insert Table 2 Here]

Table 3 presents the actual methods participants used to learn their workplace AT, including their primary learning method. Table 4 presents the percentage of participants who received formal, informal, or no training on the ten specific AT.

[Insert Tables 3 and 4 Here]

Table 5 presents the perceived skill level means by primary learning methods for the specific AT. The primary learning methods for three ATs were significantly associated with participants' perceived skill level: third-party screen reader software ($F(2, 248) = 2.84$, $p = .03$), OCR software or hardware ($F(5, 98) = 2.72$, $p = .03$), and OCR app ($F(3, 161) = 2.92$, $p = .04$).

[Insert Table 5 Here]

Discussion

Hands-on training was clearly the preferred way to learn to use new AT, with almost half of participants selecting it as their first choice and 16% more identifying it as a second or third option. Utilizing materials provided by vendors was the top preferred method for learning to use new features in updates to AT the person already used, but hands-on training was the second most preferred option. Although the preference for training as the first choice for learning both new AT and new features or updates was not associated with age, it was associated with age at onset of blindness or low vision. The older the person was when they experienced vision loss, the more likely the person was to prefer hands-on training compared to any other method. This is not surprising, given that people who have used AT for longer periods of time have likely adopted many new ATs and gone through multiple AT updates. These experiences likely made them more comfortable with managing this process on their own. However, it is important to note that a moderate to large percentage of people who experienced vision loss before or during their K-12 schooling also preferred hands-on training.

The percentage of people who received formal training for the AT they use at work varied by the AT – more than 70% of screen reader users did, but less than half of participants received formal training on most AT reviewed in this study. Rates of formal training were particularly low for the two types of apps, with one-fifth or less receiving formal training. Some participants received informal training on their AT from another person who is blind or has low vision, and this was most common for the apps. However, most participants did not receive any training, formal or informal, on the use of apps they are utilizing at work. This coincides with Martiniello et al.'s (2022) finding that few people received training on using smartphones. Satisfaction with

OCR apps was lower than most other AT used at work by our participants (McDonnall et al., 2023b); perhaps this is associated with the fact that few people received training in their use. Even if OCR apps are fairly simple to operate, receiving some instruction may increase user skill and satisfaction with an AT that is used at work by the majority of people with blindness and low vision.

Despite hands-on training being the preferred learning method for new AT, self-taught was what most people considered their primary way to learn to use specific AT. Many participants reported using tutorials and other resources provided by manufacturers to help them learn how to utilize their AT, as found by Silverman et al. (2022). A considerable number of resources for learning AT are available, including written, audio, and video tutorials from manufacturers and others; webinars hosted by manufacturers and other organizations; and electronic email lists created for people to obtain assistance with AT questions. Most of this information is freely available on the internet, although newer AT users may be unaware of the resources or unsure of how to locate them.

It is likely that people who are able to teach themselves new AT possess problem-solving skills, which also allow them to better adapt to product updates. With the speed at which technology changes today, the ability to self-teach is important if not essential. It is crucial that AT professionals teach their students to find solutions to their AT problems and provide guidance in utilizing the many resources available today to self-teach (Kamei-Hannan et al., 2023). Beyond the basics of utilizing an AT, teaching students how to problem solve and find solutions for themselves to not only the issues that will arise with AT use, but also the updates to the AT, should be a top priority.

Significant differences in self-perceived skill levels were found for three ATs based on

primary learning method: screen reader software, OCR software/hardware, and OCR apps. In all cases, individuals who reported learning to use AT primarily through training from VR or other agencies that serve people with blindness and low vision had lower self-perceived skill levels. Average skill levels for people who considered learning from another person with blindness or low vision (informal training) as their primary method were also generally lower than the other methods. These findings suggest that people need to consider their training as the first step in learning an AT and strive to continue to learn and increase their skill in its use. It does not necessarily indicate that the training provided was of poor quality, but it may suggest that the training dosage is not adequate. With the limited number of blind/low vision-specific AT specialists and even fewer CATIS-certified AT professionals (ATiA, 2022), individuals may not be receiving as much training as they need or desire.

Limitations

This study is based on self-reported data provided via a survey and is thus subject to the limitations that are inherent in survey research (e.g., sampling bias, measurement error, response bias). It was not possible to obtain a random sample of employed people who are blind or have low vision, therefore our survey relies on volunteer participants who may not be representative of the entire population. Our participants may be people who have an interest in AT and are more skilled with AT than the average employed person who is blind or has low vision. Survey questions may have been interpreted differently by different respondents or may have been misunderstood. For example, participants decided for themselves how to define their primary method of learning to utilize their AT, and respondents may have defined this differently. Participants may also have intentionally or unintentionally provided misleading information. For example, participants rated themselves on their skill level with each AT, and their perceptions

may not match an objective evaluation of their skill. Finally, we did not collect all information that may be relevant to this topic, such as the type of professional whom participants received their formal training from. It would be helpful for future studies regarding AT training to include this information.

Outcomes and Benefits

This study identified the preferred and actual methods to learn new AT for workers with blindness and low vision, how these preferences differ by age at vision loss, and how perceived skill level differs by actual learning methods for three of the most common workplace AT. Our findings contribute empirical evidence to the scarce literature about how people who are blind or have low vision learn to use their AT and highlight the discrepancy between preferred and actual learning methods. While hands-on training is preferred for learning new AT devices and software, actual learning is primarily through self-teaching. A large percentage of employed people did not receive formal training for some of the ATs they use at work, suggesting a gap between the desire for training and its availability.

The outcomes of this study inform training providers (CATISs, AT instructors, TVIs, CVRTs, VR and other agencies, and vendors) of the demand for hands-on training, common for all but particularly preferred among adults who lost their vision after completing their K-12 education. The relatively low proportion of participants who received training on some AT they use at work suggests that training is not as readily available as it should be. The findings of this study also suggest important content to include in formal training. Making training available on the use of mobile apps and the other devices in this study commonly used at work but for which few received training is also important. Given the limited amount of time AT trainers may have with students, methods for troubleshooting compatibility and accessibility issues, seeking

support services, as well as locating and utilizing available resources should be key parts of the training process. These skills should be emphasized in preparation programs for AT professionals, such as those pursuing CATIS certification eligibility. Informing the student that continued learning, beyond the training sessions, is not optional but necessary may also provide the right frame of mind to encourage continuous growth. This may include learning updates to existing AT as well as new AT, employment-specific AT training needs, or daily living AT training needs. Our findings suggest that this continuous learning mindset is beneficial for obtaining the AT skills needed for successful employment.

Because almost all participants reported that they learned to use one or more of their ATs through self-teaching, tutorials, or both, our findings emphasize the value of the numerous resources available today to assist people in learning to utilize their AT effectively. Vendor-provided new release information was the most preferred way to learn updates to existing AT. For technology companies and other developers, including individuals who provide podcasts or videos, our findings indicate that continuing to develop and offer these resources is imperative.

Conclusions

In conclusion, this study documents the importance of having AT training available to people with blindness and low vision, including those who are employed. Most of our participants preferred hands-on training to learn a new AT, and many preferred training for learning updates to existing AT. This is a challenge given the limited number of qualified AT specialists specifically trained to instruct people who are blind or have low vision, especially to support training needs in employment settings (ATiA, 2022; Kelly & Tikkun, 2017; Parker, 2020). Although the CATIS certification was launched in 2016 to address a long-existing demand for well-qualified AT instructors of people with blindness and low vision (Kelly & Tikkun,

2017), there are currently only 135 active CATISs (http://www.acvrep.org/verify). There is a tremendous need to increase the number of CATIS and other qualified professionals in the blindness field to support the demand for AT training. Our findings also indicate that training should not be the end of learning to use an AT but only the beginning. Our results make it clear that ongoing learning is needed. Thus, AT professionals should prepare students to both problem-solve issues they are bound to encounter in AT use and continue to gain knowledge and advance their skills with the many resources that are available today.

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Figure 1

Preferred Methods for Learning to Use New AT Device or Software

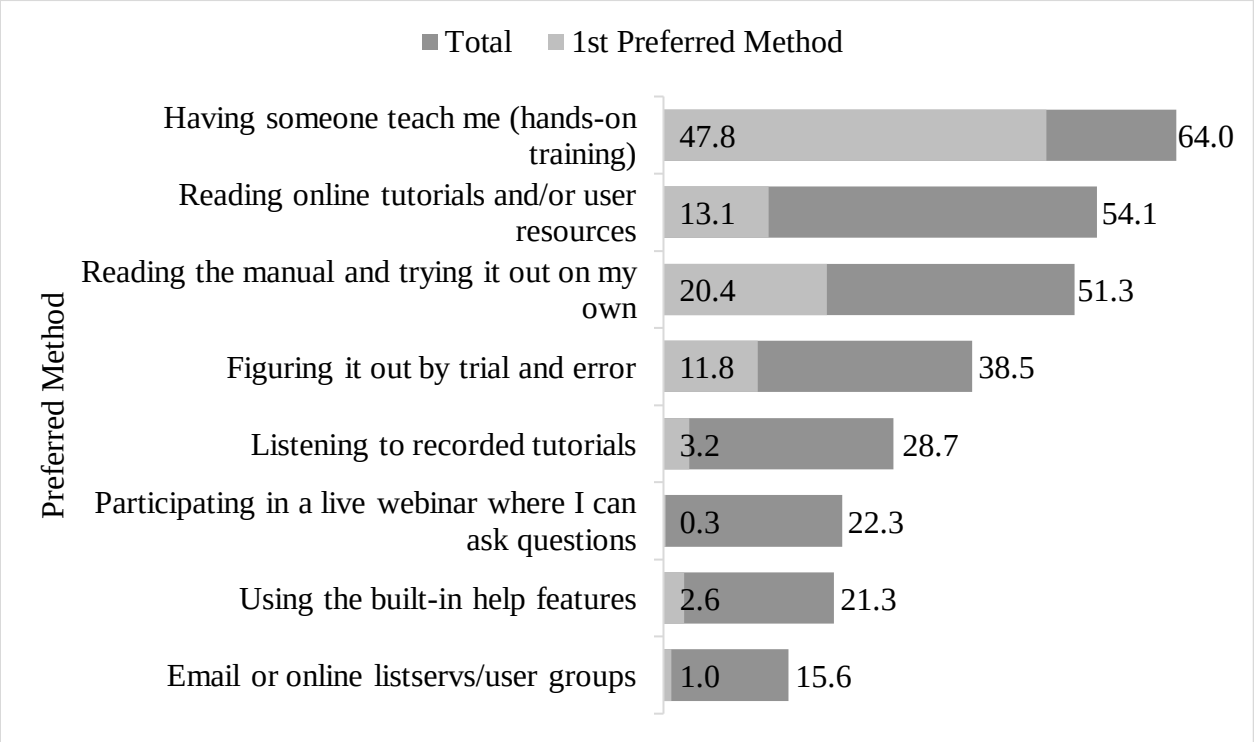

Figure 2

Preferred Methods for Learning to Use New Features or Updates

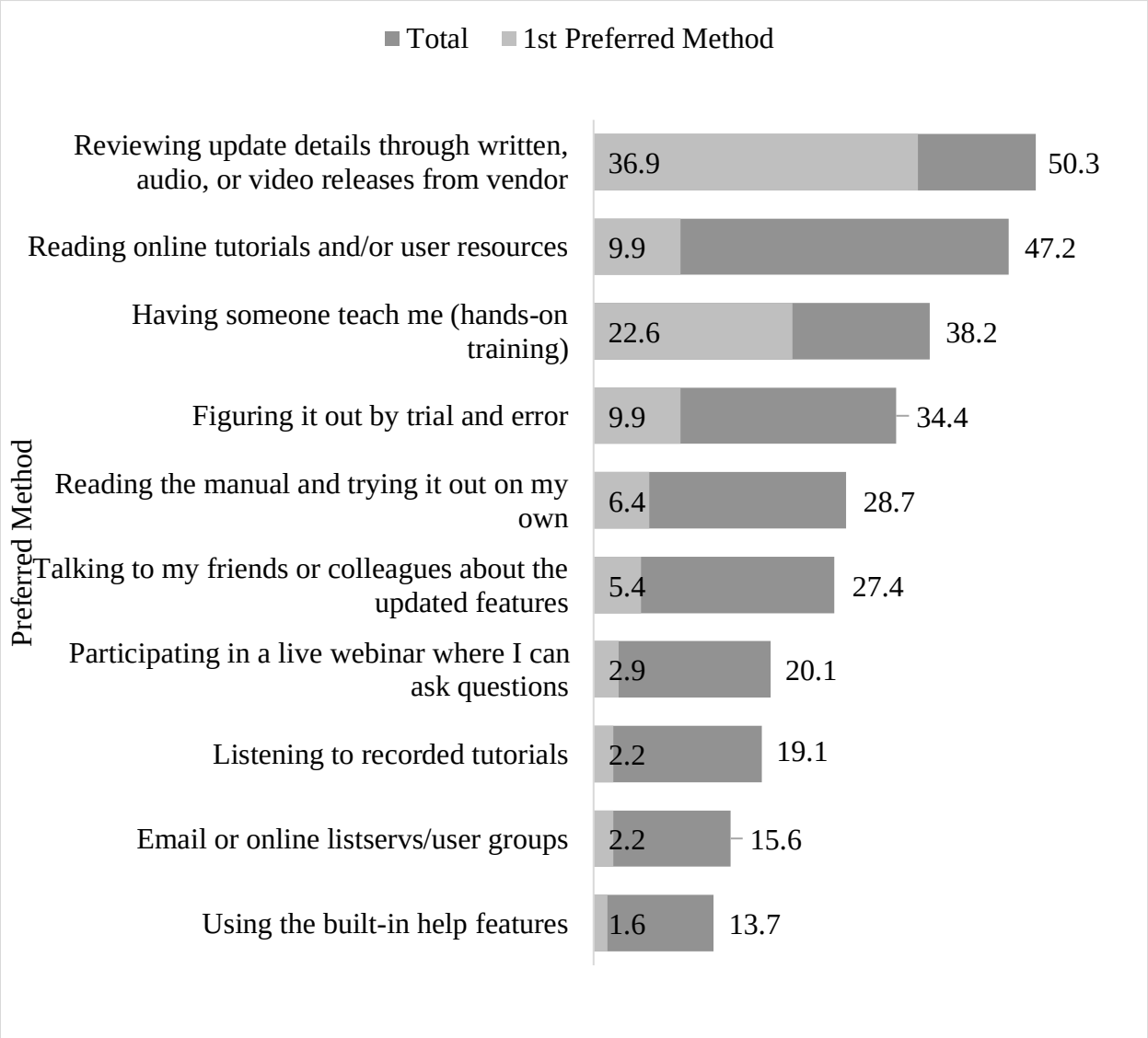

Table 1

Participant Demographics

Variable	*n*	%
Gender		
Female	193	61.5
Male	121	38.5
Race[a]		
American Indian or Alaska Native	5	1.6
Asian	20	6.4
Black or African American	21	6.7
Native Hawaiian or Other Pacific Islander	2	0.6
White	266	84.7
Other race	12	3.8
Hispanic Ethnicity		
Yes	25	8.0
No	289	92.0
Age Categories		
21-30	31	9.9
31-40	84	26.8
41-50	77	24.5
51-60	84	26.8
61 or older	38	12.1
Vision Loss Onset		
Preschool	214	68.2
Kindergarten-12th grade	47	15.0
Post school	39	12.4
40 or older	14	4.5
Education Level		
High school diploma or equivalent	10	3.2
Associate, vocational, or technical degree or certificate	47	15.0
Bachelor's degree	118	37.6
Master's degree	112	35.7
Professional or doctoral degree	27	8.6
Level of Vision		
Totally blind	190	60.5
Legally blind with minimal functional vision	65	20.7
Legally blind with some functional vision	48	15.3
Low vision, not legally blind	11	3.5
Additional disability		
Yes	112	35.7
No	202	64.3
SSI		
Yes	15	4.8
No	299	95.2
SSDI		
Yes	72	22.9
No	242	77.1

Braille Skills		
No braille skills	50	15.9
Minimal braille skills, such as using uncontracted Grade One braille	39	12.4
Moderate braille skills, such as some use of contracted Grade Two braille	43	13.7
Proficient braille skills, fluent in contracted Grade Two braille	182	58.0
Employment Type		
Employer job	217	81.9
Self-employed	29	10.9
Both	18	6.8

[a] Participants selected all races that applied.

Alt Text: Table 1 presents the participants' demographics. The table has three columns and 54 rows, with the following column headings: Variable, *n* (sample), and % (percent). The demographic variables listed in the remaining rows are: Gender (Female, Male), Race (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Other race), Hispanic Ethnicity (Yes, No), Age Categories (21-30, 31-40, 41-50, 51-60), Vision Loss Onset (Preschool, Kindergarten-12th grade, Post school, 40 or older), Education Level (High school diploma or equivalent, Associate, vocational, or technical degree or certificate, Bachelor's degree, Master's degree, Professional or doctoral degree), Level of Vision (Totally blind, Legally blind with minimal functional vision, Legally blind with some functional vision, Low vision, not legally blind), Additional Disability (Yes, No), SSI (Yes, No), SSDI (Yes, No), Braille Skills (No braille skills, Minimal braille skills, such as some use of contracted Grade Two braille, Proficient braille skills, such as fluent in contracted Grade Two braille), and Employment Type (Employer job, Self-employed, both).

Table 2

Top Preferred Learning Method by Age at Vision Loss Categories

Variable	Preschool		K-12		Postschool		40 +		X^2	*p*	Φ
	n	%	*n*	%	*n*	%	*n*	%			
New AT Learning Method									16.82	<.01	.23
Resources	41	19.2	7	14.9	6	15.4	1	7.1			
Self	87	40.7	12	25.5	7	18.0	3	21.4			
Training	86	40.2	28	59.6	26	66.7	10	71.4			
AT Updates Learning Method									26.01	<.01	.29
Resources	51	23.8	12	25.5	8	20.5	0	0.0			
Self	130	60.8	19	40.4	17	43.6	6	42.9			
Training	33	15.4	16	34.0	14	35.9	8	57.1			

Alt Text: Table 2 presents the top preferred learning methods by age at vision loss and the chi-square statistic for learning new AT and learning AT updates. This table has 12 columns and 12 rows, containing the following column headings: Variable, Preschool [subheading: *n* (sample), % (percent)], K-12 [subheading: *n* (sample), % (percent)], Postschool [subheading: *n* (sample), % (percent)], 40+ [subheading: *n* (sample), % (percent)], Wald chi-square (X^2), *p*, and Φ (phi coefficient). The remaining rows include the learning methods for New AT Learning (Resources, Self, Training) and the learning methods for AT Updates Learning (Resources, Self, Training).

Table 3

Actual Learning Methods for AT Used at Work

AT Device/Software/ App	Self-taught	VR/Agency training	Tutorials	Person with VI	In school (by a TVI)	Vendor	Other	Other training
Screen reader software (3rd party)	81.9 (44.2)	57.0 (25.3)	66.0 (12.8)	55.9 (8.3)	23.8 (7.9)	21.5 (0.8)	4.2 (-)	3.8 (0.8)
Screen magnification software (3rd party)	88.5 (67.3)	46.2 (26.9)	30.8 (1.9)	15.4 (-)	9.6 (1.9)	9.6 (1.9)	1.9 (-)	1.9 (-)
Built-in screen reader	88.1 (66.1)	31.4 (11.0)	66.1 (6.8)	40.7 (11.0)	15.3 (1.7)	17.0 (1.7)	3.4 (-)	2.5 (1.7)
Built-in screen magnification	92.5 (87.5)	22.5 (5.0)	30.0 (-)	15.0 (2.5)	5.0 (2.5)	7.5 (2.5)	-	-
OCR software or hardware	81.2 (60.2)	30.8 (14.3)	38.4 (7.5)	30.1 (9.0)	7.5 (4.5)	18.1 (3.8)	2.3 (0.8)	1.5 (-)
Braille notetaking device	88.6 (62.0)	20.3 (5.1)	57.0 (10.1)	30.4 (7.6)	21.5 (10.1)	32.9 (3.8)	-	2.5 (1.3)
Refreshable braille display	90.8 (70.0)	16.2 (6.2)	56.9 (12.3)	29.2 (5.4)	9.2 (2.3)	20.0 (3.1)	0.8 (-)	0.8 (0.8)
Electronic video magnifier	71.8 (56.4)	41.0 (23.1)	25.60 (-)	12.8 (2.6)	10.3 (10.3)	15.4 (7.7)	-	-
OCR app	89.9 (76.7)	10.7 (4.1)	30.0 (9.6)	26.4 (8.6)	0.5 (-)	4.1 (-)	2.0 (1.0)	-
Navigation/ wayfinding app	87.7 (71.9)	14.0 (6.1)	30.7 (7.0)	31.6 (12.3)	2.6 (0.9)	5.3 (1.8)	1.8 (-)	-

Note. All numbers are percentages. The numbers in parentheses represent the percentage who reported that method as their primary learning method. VI = visual impairment. TVI = teacher of students with visual impairments.

Alt Text: Table 3 presents the percentage of participants who used a particular AT at work by learning method. The table has 9 columns and 11 rows, containing the following column headings: AT Device/Software/App, Self-taught, VR/Agency training, Tutorials, Person with VI, In school (by a TVI), Vendor, Other, and Other training. Assistive technology are listed in the remaining rows headers: Screen reader software (3rd party), Screen magnification software (3rd party), Built-in screen reader, Built-in screen magnification, OCR software or hardware, Braille notetaking device, Refreshable braille display, Electronic video magnifier, OCR app, and Navigation/wayfinding app.

Table 4

Percentage who Received Formal, Informal, or No Training for AT Used at Work

Assistive Technology	Received formal training	Received informal training	Did not receive training
Third-party screen reader software	72.0	9.6	18.5
Electronic video magnifier	62.5	7.5	30.0
Third-party screen magnification software	59.6	5.8	34.6
Braille notetaking device	56.3	8.8	35.0
OCR software or hardware	45.9	14.8	39.3
Built-in screen reader	45.1	14.8	40.2
Refreshable braille display	35.1	16.8	48.1
Built-in screen magnifier	29.3	4.9	65.9
Navigation/wayfinding app	19.8	20.7	59.5
OCR app	13.0	23.5	63.5

Note. Received formal training includes training by a teacher of students with visual impairments, VR or other agency for the blind or vendor, or other. Received informal training includes people who learned by another person who is visually impaired and did not receive formal training.

Alt Text: Table 4 presents the percentage of participants who used a particular AT at work by the type of training received. The table has 4 columns and 11 rows, with the following column headings: Assistive Technology, Received formal training, Received informal training, and Did not receive training. The remaining row headings list the types of assistive technology: Third-party screen reader software, Electronic video magnifier, Third-party screen magnification software, Braille notetaking device, OCR software or hardware, Built-in screen reader, Refreshable braille display, Built-in screen magnifier, Navigation/wayfinding app, and OCR app.

Table 5

Means, Standard Deviations, and ANOVA Results for Skill Level by Primary AT Learning Method

Assistive Technology	*n* (A)	*M (SD)* (A)	*n* (I)	*M (SD)* (I)	*n* (S)	*M (SD)* (S)	*n* (V)	*M (SD)* (V)	*n* (T)	*M (SD)* (T)	*F*	*df*	*p*
Screen reader software (3rd party)	20	8.05 (1.39)	21	8.52 (1.21)	111	8.47 (1.36)	67	7.79 (1.46)	34	8.18 (1.40)	2.84	4, 248	.03
Screen magnification software (3rd party)					33	7.30 (2.34)	13	6.85 (2.27)			0.36	1, 44	.55
OCR software or hardware	8	6.38 (2.39)	4	8.50 (1.91)	66	7.50 (1.68)	13	6.31 (2.10)	8	8.25 (1.28)	2.72	5, 98	.03
Braille notetaking device	5	7.40 (3.13)	8	9.00 (1.41)	43	7.79 (2.10)	4	6.75 (2.99)	7	8.86 (1.07)	1.31	4, 62	.28
Refreshable braille display	5	8.60 (1.34)			77	7.55 (2.22)			15	7.40 (2.03)	0.62	2, 94	.54
Electronic video magnifier			4	9.75 (0.50)	21	8.19 (2.06)	7	8.14 (2.61)			0.99	2, 29	.38
OCR app	14	6.57 (1.91)			126	7.98 (2.02)	7	6.57 (3.26)	18	7.28 (2.59)	2.92	3, 161	.04
Navigation/wayfinding app	9	8.00 (1.22)			56	7.70 (1.72)	5	7.80 (2.28)	5	8.40 (1.14)	0.33	3, 71	.81

Table Key: A = Another person with VI; I = In school (by a TVI); S = Self-taught; V = VR/Agency for the blind training; T = Tutorials

Note: OCR software or hardware: Vendor $n = 5$, $M = 8.60$, $SD = 1.14$. VI = visual impairment. TVI = teacher of students with visual impairments.

Alt Text: Table 5 presents the means, standard deviations, and ANOVA results of participants' skill level with AT by primary AT learning method. The table has 14 columns and 10 rows, containing the following column headings: Assistive Technology, Another person with VI [subheadings: *n* (sample), *M (SD)* (mean and standard deviation)], In school (by a TVI) [subheadings: *n* (sample), *M (SD)* (mean and standard deviation)], Self-taught [subheadings: *n* (sample), *M (SD)* (mean and standard deviation)], VR/Agency training [subheadings: *n* (sample), *M (SD)* (mean and standard deviation)], Tutorials [subheadings: *n* (sample), *M (SD)* (mean and standard deviation)], *F*, *df*, *p*. AT listed in the remaining row headings include: Screen reader software (3rd party), Screen magnification software (3rd party), OCR software or hardware, Braille notetaking device, Refreshable braille display, Electronic video magnifier, OCR app, and Navigation/wayfinding app.