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Comparison of Assistive Technology Use and Beliefs Among Employed and Unemployed People who are Blind

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Introduction: Digital skills are essential for today's workforce. To possess the digital skills needed in so many jobs, people with visual impairments must have adequate assistive technology (AT) skills. Lack of the necessary AT skills may be one reason for unemployment.

Method: This study included 325 blind or legally blind respondents who completed an online or phone survey in 2021. Participants reported on AT utilized and self-perceived AT skill level, training needs, and self-efficacy. We evaluated group differences between employed and unemployed participants on the top 10 workplace AT utilizing Chi-square and *t*-tests.

Results: There were five significant differences between the groups in AT use, two in training needs, and none in skill level or self-efficacy. In addition, employed people reported significantly higher braille proficiency. Effect sizes were generally small.

Discussion: Both employed and unemployed participants considered themselves highly skilled with their AT, and most had high AT self-efficacy. However, training needs were relatively high for both groups on many common workplace AT. The lack of substantial differences between the groups suggests that employment status has minimal associations with AT beliefs.

Application for Practitioners: Vision rehabilitation professionals must ensure that their consumers have the necessary AT skills to work efficiently in our digital workforce. Our findings suggest that the most universally utilized AT on the job by blind employees are screen readers, apps on mobile devices, and OCR technology. For professionals

preparing consumers for the workplace, it is vital to ensure that they are skilled with these technologies.

Comparison of Assistive Technology Use and Beliefs Among Employed and Unemployed People who are Blind

Obtaining and maintaining employment can be a challenge for people who are blind or have low vision (i.e., those with visual impairments). Historically, people with visual impairments have been substantially less likely to be employed and more likely to be unemployed than the general population (McDonnall & Sui, 2019). Unemployment is defined as not currently working for pay but actively seeking work and being available to work (U.S. Bureau of Labor Statistics, 2014). In 2019, the unemployment rate for people with visual impairments was more than double that for people without disabilities (8.5% compared to 4.1%) (U.S. Census Bureau, 2020).

Digital skills have become increasingly important in the workplace, a trend that is expected to continue (Muro et al., 2017). To possess the digital skills needed in so many jobs in the U.S. economy, people with visual impairments must first have adequate AT skills. Thus, one potential barrier to employment for people with visual impairments is a lack of assistive technology (AT) skills, which may stem from a lack of access to AT or appropriate training. Despite the importance of AT skills for their employment, little is known about how adults with visual impairments use AT on the job.

Numerous studies have addressed AT use by people with visual impairments in daily life, most of which have focused on smartphones as AT. Tan and colleagues (2022) conducted a scoping review of smartphone use by people with visual impairments in which they reviewed 65 related articles. Most of the studies were conducted in countries outside of the U.S. and focused on use of a specific app. Only a few studies evaluated the general use of smartphones or apps. The authors noted that training and learning support appears to be lacking in smartphone use by people with visual impairments. Another study compared use of smartphones or tablets with traditional, stand-alone ATs for specific tasks (Martiniello et al., 2019). This study provided valuable information about how people with visual impairments used traditional AT and smartphones in 2017. Few other studies have assessed everyday AT use outside of smartphones or mobile apps. One such study evaluated use of magnification in digital reading displays (Granquist et al., 2018), and another investigated use of a wide variety of technologies to help people with visual impairments function in everyday life (Reyes-Cruz et al., 2020).

Only a few studies have investigated AT use by people with visual impairments on the job. Three of those studies comprised small samples (5 people each) and thus utilized qualitative methodology (Branham & Kane, 2015; Halbach et al., 2022; Wahidin et al., 2018). The studies investigated work-related AT challenges and found that inaccessible items (including software, websites, documents, and office equipment) were substantial problems. Branham and Kane (2015) also discussed the challenges AT can present when collaborating with sighted coworkers. Wahidin and colleagues (2018) commented on the importance of a supportive work environment to successfully utilize AT on the job. Halbach and colleagues (2022) noted that many employees were given alternative job tasks due to incompatibility between AT and company software. While these studies' findings are valuable, they have limited generalizability due to their small sample sizes. The American Foundation for the Blind recently surveyed people with visual impairments about workplace technology use (Silverman et al., 2022). Similar to the other studies, accessibility challenges with mainstream technology tools was one of their key findings.

Information is also lacking regarding AT self-efficacy and skill level of people with visual impairments and, relatedly, their need for training with AT. Interestingly, several studies have addressed these topics for teachers of students with visual impairments (e.g., Abner & Lahm, 2002; Ajuwon et al., 2016; Zhou et al., 2011, 2019), but few studies have evaluated the topics for working-age adults with visual impairments. Although not a focus of their study, Martiniello et al. (2019) documented that most of their respondents considered themselves to have advanced proficiency with AT, and very few considered themselves beginners. No studies have been published that included a measure of AT self-efficacy of individuals with visual impairments or this population's perceived AT training needs.

AT studies that included employed and unemployed people (e.g., Martiniello et al., 2019) have not evaluated potential differences in AT use based on employment status. We propose that there may be differences in AT use among employed and unemployed people. Further, there may be differences in AT beliefs of people based on employment status, such as perceived skill level, need for training, and self-efficacy. If differences in these areas exist, they may help explain the reasons for lack of employment. We utilized the following three research questions to guide our study:

1. Does the use of common workplace AT differ among employed and unemployed people who are blind?
2. Do self-perceived AT skill level and AT training needs for commonly used workplace AT differ for employed and unemployed people?
3. Does AT self-efficacy differ for employed and unemployed people who are blind?

Method

Participants

The authors' university's Institutional Review Board for the Protection of Human Subjects determined this study to be exempt from institutional review board oversight. Recruitment began in January 2021 for people with visual impairments who were employed or unemployed (i.e., not working but interested in working) via advertisements to a national registry, consumer organizations, social media, listservs, and blindness-specific websites such as Blind Bargains. Interested participants completed a screening survey to determine eligibility for the study. Eligibility criteria were being blind or having low vision, age 21 or older, and living in the United States or Canada. Employed participants were also required to work at least 15 hours per week, use AT on the job, and plan to work for the next four years. Unemployed participants were also required to use AT regularly and be interested in working.

This study included 325 survey respondents (244 employed; 81 unemployed) who reported being totally blind or legally blind with minimal functional vision. Most (96.3%, n=313) participants were from the United States, representing 46 states. The remaining 3.7% (n=12) of participants were from Canada, representing five provinces. Participants ranged in age from 21 to 90 years old, with an average age of 45.17 years (SD=12.82). The average age for employed participants was 45.94 years (SD=12.28, range 22–89), and unemployed participants' average age was 42.85 years (SD=14.17, range 21–90). Additional participant characteristics, overall and by group, are presented in Table 1.

Data Collection

Eligible participants were invited to complete the survey via an accessible online survey platform or by phone. Employed participants completed the survey between May and September 2021, and unemployed participants completed the survey between July and December 2021. Participants received a small electronic gift card upon survey completion.

Measures

Data for this study came from two separate but similar surveys (i.e., an employed version and an unemployed version). The surveys collected information about AT utilized, most frequently used AT, skill level with and training needs for currently utilized AT, tasks for which AT is used, satisfaction with AT, and AT self-efficacy, among other topics. This study focused on AT utilized, participants' skill level and training needs, and AT self-efficacy. To identify AT utilized, participants were provided a list of 28 ATs - employed participants selected AT used on the job; unemployed participants selected AT utilized in daily life. Participants rated their skill level with each selected AT on a 10-point scale (1=*beginner,* 10=*advanced*). Those who rated their skill level 7 or below were asked if they would benefit from more training on using that AT.

We measured participants' AT self-efficacy using Laver et al.'s (Laver et al., 2012) scale, which was modified from an existing computer self-efficacy scale to be utilized with people with disabilities about using new technologies. Laver and colleagues reported high internal consistency reliability (Cronbach's alpha=.94) and provided support for construct validity for their modified scale. Participants rated their confidence about using a new AT under 10 conditions on a 1 to 10 scale (1=*not at all confident*, 10=*completely confident*). We made a few minor changes to the scale instructions to make the measure specific to AT and more applicable to our study (i.e., added the word "assistive" in front of "technology", replaced the example of a technology after the phrase "for some aspect of daily living" with "or your work"). Sample items include "I could use the technology if I had never used a product like it before." and "I could use the technology if someone showed me how to do it first." We generated participants' AT self-efficacy scores by summing the 10 items. Scores could range from 10 to 100; actual scores ranged from 33 to 100.

Data Analysis

We used SAS 9.4 to generate descriptive statistics (i.e., frequencies or means) for participant demographics, AT utilized, perceived skill level, training needs, and AT self-efficacy. To conduct comparisons between groups, we focused on only the top 10 most commonly utilized workplace AT, as determined by employed respondents. Chi-square tests were used for AT utilized and training needs, and *t*-tests were used for AT skill levels and self-efficacy. Fisher's exact test results were utilized when cell frequencies were below five. Cohen's *d* and Cramer's *V* were used to determine effect sizes for *t*-tests and chi-square, respectively. Because we conducted a large number of statistical significance tests, we used the Benjamini-Hochberg correction for false discovery rate for each set of tests by research question (Glickman et al., 2014).

Results

Participant Characteristics

Participant demographics appeared different across groups in terms of race (higher percentage of unemployed were Black and American Indian/Alaska Native), education level (employed group was more highly educated), and additional disabilities (higher in the unemployed group; see Table 1). Other differences included a higher percentage of unemployed participants who received disability benefits and a lower percentage who experienced vision loss at birth/before age 1. Self-reported braille skills also appeared to differ between groups, with a higher percentage of the employed sample reporting proficient skills and a lower percentage reporting no skills. The observed differences, except age of vision loss, have been noted in other studies that investigated factors associated with employment for people with visual impairments (Lund & Cmar, 2019b, 2019a). Because the relationship between braille skills and employment is of interest to the field, we conducted a Chi-square analysis to determine if the apparent difference reached statistical significance. We found that employed people self-reported significantly higher braille skills than unemployed people: $\chi^2(3, N=325)=13.08$, $p=.005$, $V=.20$.

AT Use

Table 2 provides the percentage of each group that utilizes the 28 AT, sorted by AT use by the employed group. The employed group was significantly more likely to use screen reader software and a refreshable braille display than the unemployed group. In contrast, the unemployed group was significantly more likely to use a remote sighted assistance app, a digital reading app, and other apps on smartphones/tablets.

AT Skill

Table 3 presents the average skill level by group for the top 10 workplace AT. The employed and the unemployed groups self-reported similar skill levels, with both groups reporting high skill levels across the 10 AT. There was a noticeable difference in skill level for screen reader software, but this difference was not statistically significant due to the Benjamini-Hochberg correction for multiple tests.

Training Needs

The percentages of employed and unemployed participants who indicated they would benefit from more training on an AT they currently use are displayed in Table 4. The need for training differed between the groups on only two ATs. The unemployed group was more likely to report a need for training with screen reader software and built-in accessibility features on a computer.

Self-efficacy Levels

Lastly, there was no difference in AT self-efficacy between the employed group (M=77.31, SD=13.83) and the unemployed group (M=76.14, SD=15.12): $t(317)=0.64$, p=.52.

Discussion

This study compared AT use and AT beliefs about self-efficacy, skill level, and training needs among employed and unemployed people who are blind. Most significant differences were observed in AT utilized, but some differences may be associated with the employed sample reporting only on AT used at work, while the unemployed sample reported on AT used in daily life. A high percentage of both groups utilized apps on mobile devices, as found by Martiniello et al. (2019), but only 4 out of the 10 most commonly used workplace AT were apps. Three of the remaining common workplace AT were computer access technology – including screen readers, which were overwhelmingly the most universally-used workplace technology. Unemployed people were less likely to use some computer access technology, such as screen reader software and refreshable braille displays. A notable difference for an AT that was not a top 10 workplace AT was greater use of dictation software for the computer among unemployed people. Unemployed people were three times more likely to use this AT. While results are not conclusive, our findings suggest lower computer access skill among unemployed people. Although not a focus of the study, we found employed people were significantly more likely to report higher proficiency with braille.

Overall, there were few significant differences between the groups, and the differences were small in terms of effect size. The only exception was the medium effect for braille proficiency differences. Both employed and unemployed participants considered themselves to be highly skilled with their AT and most have high AT self-efficacy. This coincides with Martiniello et al.'s (2019) finding of high self-reported AT proficiency levels in their sample. The lack of substantial differences between the groups suggests that employment status has minimal associations with AT beliefs.

A potential reason for this finding is that some employed people have not been working for long and, in fact, several were recently unemployed. Thirteen employed participants signed up to be in the unemployed study group but had obtained employment by the time we administered the survey. Likewise, amount of work experience differed substantially for the unemployed group – only 14.8% had never worked while 38.3% worked between 15 and 56 years (although some work years were before vision loss for several study group members). In addition, some lost their jobs due to the pandemic and may have been able to quickly find new jobs after completing the survey. The category that participants were in (employed or unemployed) is fluid, and all participants were either working or wanted to work. Results may be different if comparing a group of people who are not interested in working and have removed themselves from the labor force. Finally, it is also worthwhile to consider that some unemployed people do not use workplace AT to the extent employed people do (e.g., frequent use or requirement to work quickly) and therefore may have an unrealistic view of their skill level.

Training needs were relatively high for both groups on many of the common workplace AT and were higher for the employed group in some cases. One-quarter or more of the employed group would benefit from additional training on 7 of the 10 most common workplace AT, compared to only 4 out of 10 ATs for which a quarter or more of the unemployed participants reported a training need. The percentage of each group that would benefit from additional training differed for several workplace AT, but only training needs for two AT were significantly different – screen reader software and built-in accessibility features on a computer. Both are related to computer access, and the unemployed group reported a greater need for training.

This finding suggests that blind job seekers may need assistance preparing for the computer demands of most jobs. This is an important point given that 98% of our employed sample uses a computer at work. The need for training for our unemployed participants may be underestimated for two reasons. First, some may not be aware of the AT skill levels needed to keep up with the demands of a job; as mentioned previously, their skills may be adequate for their current AT use, but requirements may be different on the job. Second, a higher percentage of unemployed participants did not use some of the common workplace AT and therefore were not asked about their related training needs. We might assume that most participants who did not currently use the AT would need training, and possibly extensive training, if they needed to use that AT on the job.

The limitations of this study should be mentioned. First, the samples cannot be considered representative of the entire populations of employed and unemployed blind people. Also, our sample of unemployed people was relatively small. Comparisons between groups on AT used are not exact contrasts, as employed people reported only on AT they use on the job while unemployed people reported on AT used at any time. Some of the differences in AT use we found are likely due to this. Finally, our measure of skill was based on self-report only, which may not coincide with actual skill level.

Application for Practitioners

Unemployment was at a historic low at the time of this writing, providing an opportunity for blind job seekers, but they must have adequate AT skills to compete in the increasingly digital workplace. It is essential for vision rehabilitation professionals to ensure that their consumers have the necessary AT skills to work efficiently. Although AT needed for specific jobs may differ, our findings suggest that the most universally utilized AT on the job by blind employees are screen readers, apps on mobile devices, and OCR technology. For professionals preparing consumers for the workplace, it is vital to ensure that they are skilled with these technologies. Computer access skills are needed for most jobs in today's economy, particularly middle-skill and higher-level jobs (Burning Glass Technologies, 2015). Job seekers would benefit from not only training on, but regular use of, computer access technology. Helping consumers obtain a computer and access technology, if they do not already have them, would be valuable to help them prepare for employment.

Apps on a smartphone or tablet were also very commonly utilized at work by people who are blind – 88.5% of employed participants used one or (usually) more apps at work. Skills with a mobile device should also be part of the AT training that job seekers receive, but research suggests most people are not receiving this training from vision rehabilitation professionals (Martiniello et al., 2019). Most employed people - 74.2% - used OCR technology (software or apps) at work. Even though using an OCR app is fairly simple, many people in our study reported difficulty obtaining a good result, so specific training with an OCR app, OCR software, or both, would be beneficial.

Although the need for training was higher for unemployed participants on most AT, many employed participants would benefit from training on some commonly used workplace AT. It can be challenging to provide training to employed people, particularly those working full-time. How can this training be provided, and who will pay for the services? This issue needs to be solved to allow employed people who are blind to become more proficient and advance in their careers. Although our results cannot be considered conclusive evidence, they suggest the value of braille skills for employment. Braille skills can be a valuable tool to improve proficiency for people who cannot access print. Thus, it is essential that all consumers be provided the opportunity to learn braille and the support and encouragement to do so.

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Table 1

Participant Characteristics Overall and by Employment Status

Variable	Overall		Employed		Unemployed	
	n	%	*n*	%	*n*	%
Sex[a]						
Female	196	60.3	148	60.7	48	59.3
Male	128	39.4	96	39.3	32	39.5
Ethnicity	31	9.5	24	9.8	7	8.6
Race						
White	261	80.3	201	82.4	60	74.1
Black/African American	30	9.2	15	6.2	15	18.5
Asian	24	7.4	19	7.8	5	6.2
American Indian/Alaska Native	11	3.4	5	2.1	6	7.4
Native Hawaiian/Other Pacific Islander	3	0.9	2	0.8	1	1.2
Some other race	19	5.6	13	5.3	6	7.4
Education						
Less than high school	2	0.6	0	0.0	2	2.5
High school	17	5.2	9	3.7	8	9.9
Some college/Associates/Vocational technical degree	62	19.1	35	14.3	27	33.3
Bachelor’s degree	125	38.5	97	39.8	28	34.6
Graduate degree	119	36.6	103	42.2	16	19.8
Age at Vision Loss						
Birth/before age 1	184	56.6	145	59.4	39	48.2
1 to 20	87	26.8	65	26.6	22	27.2
21 to 40	43	13.2	27	11.1	16	19.8
41 or older	11	3.4	7	2.9	4	4.9
Additional disabilities	125	38.5	83	34.0	42	51.9
Receive SSI[b]	41	13.1	14	6.0	27	34.2
Receive SSDI[b]	109	34.8	60	25.6	49	62.0
Braille Skills						
Proficient braille skills	206	63.4	163	66.8	43	53.1
Moderate braille skills	52	16.0	38	15.6	14	17.3
Minimal braille skills	38	11.7	29	11.9	9	11.1
No braille skills	29	8.9	14	5.7	15	18.5

Note. N=325 (Employed *n*=244, Unemployed *n*=81). SSI=Supplemental Security Income; SSDI=Social Security Disability Insurance.

[a] One person preferred not to answer this question.

[b] Limited to those in the United States only. *N*=313 (*n*=234 for Employed, *n*=79 for Unemployed).

Table 2

AT Used by Group and Chi-Square Comparisons

AT Type	Employed		Unemployed		$\chi^2(1)$	*p*	*V*
	n	%	*n*	%			
Screen reader software	233	95.5	70	86.4	7.93	.005*	-0.16
OCR app	155	63.5	56	69.1	0.84	.36	0.05
Other apps on smartphone or tablet[a]	151	61.9	67	82.7	11.95	.001*	0.19
Built-in accessibility features on a computer	126	51.6	49	60.5	1.92	.17	0.08
Remote sighted assistance app	118	48.4	54	66.7	8.18	.004*	0.16
OCR software/hardware	107	43.9	28	34.6	2.16	.14	-0.08
Refreshable braille display	103	42.2	21	25.9	6.84	.009*	-0.15
Digital reading app	87	35.7	45	55.6	9.98	.002*	0.18
Braillewriter	80	32.8	24	29.6	0.28	.60	-0.03
Braille notetaking device	77	31.6	24	29.6	0.11	.75	-0.02
Navigation/wayfinding app	74	30.3	32	39.5			
Digital reading software/device	72	29.5	42	51.9			
Braille labeling system	71	29.1	28	34.6			
Audio recorder app	62	25.4	27	33.3			
Money identification app	61	25.0	33	40.7			
Other identification app	59	24.2	32	39.5			
Audio recorder	41	16.8	24	29.6			
Digital labeling technology	26	10.7	22	27.2			
Screen magnification software	20	8.2	7	8.6			
Electronic video magnifier	18	7.4	6	7.4			
Dictation/speech recognition software	17	7.0	17	21.0			
Other built-in accessibility features	14	5.7	7	8.6			
Orientation, wayfinding, or navigation device	13	5.3	12	14.8			
Digital labeling app	11	4.5	10	12.4			
Wearable device	10	4.1	5	6.2			

Handheld lens magnifier	9	3.7	6	7.4
Handheld electronic video magnifier	8	3.3	6	7.4

Note. OCR=Optical Character Recognition.

[a] Other apps refer to apps not in the provided list of AT.

*Significant difference determined based on Benjamini-Hochberg correction.

Table 3

Average Skill Level for the Top 10 Workplace AT by Employment Status

AT Type	Employed				Unemployed				*t*	*p*	Cohen's *d*
	n	*M*	*SD*	Range	*n*	*M*	*SD*	Range			
Screen reader software	229	8.24	1.39	2-10	70	7.77	1.95	1-10	2.25	.03	0.31
OCR app	153	7.56	2.18	1-10	55	7.62	1.99	1-10	-0.17	.87	-0.03
Other apps on smartphone/tablet	146	8.30	1.40	4-10	63	8.32	1.65	2-10	-0.07	.94	-0.01
Built-in accessibility features on a computer	123	7.76	2.07	1-10	49	7.37	1.88	3-10	1.14	.26	0.19
Remote sighted assistance app	117	8.27	2.00	2-10	54	7.85	2.03	1-10	1.25	.21	0.21
OCR software or hardware	105	7.20	2.07	1-10	28	7.04	2.19	3-10	0.37	.71	0.08
Refreshable braille display	101	7.49	2.20	1-10	21	7.43	2.46	1-10	0.11	.92	0.03
Digital reading app	87	8.58	1.34	3-10	45	8.11	1.91	3-10	1.62	.11	0.30
Braillewriter	80	9.16	1.60	2-10	24	9.46	0.98	7-10	-0.86	.39	-0.20
Braille notetaking device	77	7.88	2.01	2-10	24	8.33	1.69	4-10	-0.99	.32	-0.23

Note. OCR=Optical Character Recognition.

Table 4

Training Needs for the Top 10 Workplace AT by Employment Status

AT Type	Employed		Unemployed		$\chi^2(1)$	*p*	*V*
	n	%	*n*	%			
Screen reader software	58	25.3	29	41.4	6.74	.009*	0.15
OCR app	61	39.9	16	29.1	2.02	.16	-0.10
Other apps on smartphone or tablet	36	24.7	10	15.9	1.98	.16	-0.10
Built-in accessibility features on a computer	32	26.0	24	49.0	8.42	.004*	0.22
Remote sighted assistance app	20	17.1	11	20.4	0.27	.61	0.04
OCR software/hardware	41	39.1	13	46.4	0.50	.48	0.06
Refreshable braille display	34	33.7	5	23.8	0.78	.38	-0.08
Digital reading app	13	14.9	7	15.6	0.01	.93	0.01
Braillewriter	2	2.5	0	0.0	0.61	.59	-0.08
Braille notetaking device	23	29.9	5	20.8	0.75	.39	-0.09

Note. OCR=Optical Character Recognition.

*Significant difference determined based on Benjamini-Hochberg correction.