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# Beyond Accessibility: Understanding the Ease of Use and Impacts of Digital Collaboration Tools for Blind and Low Vision Workers

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Real-time collaboration tools (e.g., videoconferencing or project management) are central to modern work but often pose significant accessibility challenges for blind and low vision (BLV) people. While these tools can support both in-person and remote collaboration, barriers to usability and access can hinder full workforce participation. Prior research has explored accessibility issues with specific tools, but broader insights into how BLV people use and experience mainstream collaboration platforms remain limited. We conducted an online survey with 155 BLV users, evaluating the ease of using 30 widely used collaboration tools. Findings show that Zoom is rated as the easiest tool to use, however, project management and whiteboarding tools are rated relatively difficult to use. Over half of the respondents reported that accessibility barriers negatively impact their collaboration, job performance, and career growth. We discuss the compounding effects of inaccessible collaborative tools and offer design recommendations for more inclusive digital workspaces.

CCS Concepts: • **Human-centered computing** → **Empirical studies in accessibility**.

Additional Key Words and Phrases: collaborative tools, workplace, accessibility, usability

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## 1 Introduction

The proliferation of real-time collaboration technologies for distributed teams—such as tools for videoconferencing, asynchronous messaging, collaborative writing, project management, and sketching and brainstorming—have transformed how people collaborate, coordinate activity, and share knowledge in-person and at a distance. Computer-based work that can be done from anywhere has many advantages for people with disabilities, who often face challenges commuting or find shared office environments inaccessible [21]. Blind and low vision (BLV) people, for instance, are performing computer-based work at increasing rates [4, 5, 26]. BLV people, however, still face employment gaps compared to their sighted peers, with roughly a 70% unemployment rate among the 8.1 million BLV Americans [3].

Technologies that form collaboration infrastructure across many organizations are increasingly central to work practice and must be accessible to enable full participation of BLV people in the workforce. In 2021, a significant

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79% of workers globally utilized digital collaboration tools (e.g., Zoom, Google Workspace, Microsoft 365, Slack, Jira, and Miro) [39], yet learning to use them with a screen reader—software blind people use to read and navigate a graphical display—is extremely challenging. Prior studies have detailed screen reader users' experiences adopting and learning to use various collaboration technologies (e.g., [4, 5, 9, 15, 18, 26, 38, 46]). Collectively, these studies characterize a steep learning curve for each tool, limited built-in accessibility support, and the need for technical and social workarounds to make them function for collaborative work. For example, basic features within videoconferencing tools (e.g., muting/unmuting, camera status) are screen reader accessible, but keeping track of chat conversations and monitoring attendance while running a meeting is exceedingly difficult for screen reader users [4]. Similarly, collaborative writing tools offer only partial access for screen reader users, making it difficult to understand who is editing what and where in a document [9, 15]. It is not just that a single tool is inaccessible, but there are compounding effects of inaccessibility and poor usability for screen reader users across one's suite of workplace tools, creating additional work for BLV people just to make collaboration happen [6, 7]. A 2022 report by the American Foundation for the Blind [45] calls further attention to the need for understanding the accessibility of videoconferencing, messaging, and collaborative writing tools used in many workplaces. What's more, blind workers reported being denied accessibility requests, reassigned jobs, and even terminated as a result of being unable to use these mainstream tools [45].

Despite the extensive literature on the use of collaboration tools among BLV people, three key gaps in the literature remain. First, prior studies are primarily interview based with small samples of participants [4, 15, 26, 38, 46]. While these studies provide in-depth analyses of technology use among various groups of BLV people, the results are often tied to specific contexts and/or tools. Accessibility scholarship lacks a comprehensive understanding of which collaborative technologies BLV people are using most for work and their collective experiences with these tools. Second, while prior work emphasizes both the inaccessibility and difficulty using collaboration tools among screen reader users [4, 15, 26, 46], studies have yet to systematically understand the relative ease of use across many similar platforms as well as the ease of completing common tasks with these tools. Third, prior literature surfaces many implications of inaccessible collaboration tools, such as communication and coordination breakdowns, reduced productivity, and impacts on one's career [12, 15, 18]. While small-scale, interview studies point to many such issues, we lack a holistic understanding of how BLV people perceive the impacts of accessibility-related technology barriers, particularly those associated with collaboration tools, on collaboration with colleagues, job performance, and future career prospects. Moreover, we have yet to understand whether being part of an accessibility or disability focused company or job role affects these factors.

To address these gaps in the literature and establish a holistic understanding of the use of mainstream collaboration technologies for work among BLV people, we conducted an online survey with 155 BLV screen reader users. The survey assessed 30 collaboration tools, including videoconferencing, asynchronous messaging, project management, collaborative writing, and digital whiteboarding tools, as well as common tasks performed with these tools that are core to collaboration. The key findings from our study include:

- Many BLV people use videoconferencing (75% of participants), asynchronous messaging (50%), and collaborative writing (41%) tools on a weekly basis or more. Frequent use of project management and digital whiteboarding tools is relatively lower (15% and 3% respectively), despite these tools being used by others for their work.
- Of the 30 collaboration tools studied, Zoom is the only tool that is widely viewed as extremely easy to use. All other videoconferencing, asynchronous messaging, and collaborative writing tools received mixed ease of use ratings. Project management and digital whiteboarding tools skewed towards being extremely difficult to use,

with participants expressing a strong need for improved screen reader access given the visual nature of these tools.

- At the task-level, Zoom (for videoconferencing) and Slack (for asynchronous messaging) were rated more favorably than Microsoft Teams. No significant differences were observed between Google Docs and Microsoft Word Online 365 for writing.
- More than half of the participants reported that technology-related accessibility barriers affect their ability to collaborate with colleagues (51.6%), job performance (62.6%), and future career prospects (52.9%), revealing a compounding effect on their work and employment.

The present paper makes four core contributions to accessible computing and HCI. First, we provide a holistic analysis of the state of digital collaboration technology for screen reader users, benchmarking frequency of use and ease of use for 30 widely-used tools among a diverse sample of screen reader users. Second, we synthesize our findings alongside an expanding literature on ability-diverse collaboration and technology for work among BLV people, confirming and extending findings from prior interview-based studies. Third, we identify practical design considerations to support researchers and practitioners in improving the accessibility and ease of use of digital collaboration tools. Lastly, our survey instrument can serve as a tool for repeated evaluations of collaborative workplace technologies, enabling measurement of changes in accessibility over time.

## 2 Related Work

### 2.1 Disability and Work

Employment is a critical factor in improving the quality of life for people with disabilities, as it not only addresses income disparities but also promotes social inclusion and civic participation [42]. In the United States, legislative efforts, such as the Americans with Disabilities Act (ADA) of 1990, have aimed to promote employment equity by prohibiting discrimination in hiring, promotion, and workplace practices. The ADA mandates that employers provide reasonable accommodations to support employees with disabilities in performing their job duties effectively [49]. Complementing this, Section 508 of the Rehabilitation Act requires federal agencies and contractors to ensure that electronic and information technology is accessible to both employees and the public [14].

Despite these legal protections, professionals with disabilities still encounter significant obstacles to fully participating in the workforce [25, 33, 43]. Studies have shown that compliance with accessibility regulations alone is insufficient—technologies may technically meet accessibility standards yet remain difficult to learn or use efficiently [4, 7, 15]. Access to accommodations often requires individuals to disclose their disability—a process that can be fraught with stigma and fear of negative perceptions [28, 44]. Additionally, many workplace cultures have implicit ability assumptions and often lack awareness of reasonable accommodations and necessary training, contributing to ongoing exclusion and marginalization [6, 44]. Structural barriers, such as inflexible work practices or inaccessible tools, further limit opportunities for equitable participation [4–6, 11, 37, 38, 40]. These challenges indicate that policy alone is not enough and meaningful access to work for people with disabilities requires a holistic approach that integrates social, technical, and organizational dimensions of accessibility in employment.

### 2.2 Collaboration in Ability Diverse Work Contexts

HCI researchers have examined ability-diverse collaboration in various work contexts drawing attention to the complex interplay between individual access needs (e.g., interpreters or real-time captioning for team discussions [46, 52]), team

dynamics (e.g. negotiating accessible work practices [15, 18, 52]), and broader structural barriers (e.g. ableist technology procurement policies [12]). Branham and Kane [7] documented the accessibility barriers faced by BLV professionals in mixed-ability workplaces, pointing out the invisible labor required by people with disabilities to create and maintain access. This extra work often goes unnoticed by coworkers and supervisors, leading to misunderstandings regarding productivity. Alharbi et al. [5] similarly highlight the cognitive and emotional labor performed by neurodivergent individuals for attending hybrid meetings. While invisibility may reduce the risk of neurodivergent individuals being labeled as disabled, it simultaneously obscures their labor, making it less likely to be recognized by team members. Disability disclosure, especially in work contexts, is often a complex decision, as disabled individuals must weigh the potential benefits of receiving support against the risks of stigma, discrimination, or unwanted attention [28, 29, 38, 50]. Mismatched expectations and implicit ability assumptions can further harm disabled professionals, leading to barriers in collaboration and limited opportunities for career advancement [12].

Even on accessibility-aware teams, conflicting access needs often emerge, requiring ongoing negotiation to achieve shared access. Wang and Piper [52] showed how deaf-hearing teams collaboratively establish communication norms, framing accessibility as an emergent and interactional process rather than a fixed or purely technical solution to disability inclusion. Yildiz et al. [56] further demonstrated that mixed-ability virtual teams co-create bottom-up understanding of accessibility that go beyond accommodations to include social challenges such as discrimination, thereby negotiating solidarity. Despite collaborative efforts, teams continue to face persistent challenges in establishing accessible work practices—particularly in ability-diverse groups, where it can be difficult to remember and accommodate each member's access needs alongside navigating complex technologies [30]. Power dynamics further complicate these processes, especially when hierarchical structures make it difficult for junior or marginalized members to push for change [5, 12, 15, 18, 30]. To address this, Das et al. [18] stress the need to equitably distribute access labor so that disabled team members are not solely burdened with maintaining accessibility.

### 2.3 BLV Experiences with Collaborative Technologies

An extensive literature focuses on the use of collaborative productivity tools among BLV people and sighted collaborators (we provide a detailed table of this literature in Appendix Table 1). Studies have documented a range of usability issues that screen reader users encounter during virtual meetings [1, 4, 20, 26, 46]. Maintaining focus becomes especially difficult when both the screen reader and the meeting speaker demand simultaneous attention, complicating real-time engagement [4, 5, 7, 11, 30, 46]. Akter et al. [4] examine strategies employed by BLV meeting facilitators, such as extensive preparation, coordination with sighted co-hosts, and advocating for accessible meeting practices. In work contexts like software development, BLV developers rely on workarounds to overcome the inaccessibility of screen sharing during meetings and tracking tasks in project management tools [11, 38]. Similar challenges have been documented in the context of collaborative writing, requiring workarounds to deal with persistent difficulty with real-time editing, tracking changes, and maintaining awareness of co-editor activity [9, 15, 41]. Despite putting in extra effort to adapt to inaccessible or constantly evolving tools, BLV workers often struggle to be perceived as effective collaborators within their teams [7, 11, 15]. In recent years, digital whiteboards have grown in use for brainstorming and planning activities, introducing yet another layer of inaccessibility for ability-diverse collaboration [18, 22]. Das et al. [18] highlight the difficulty of accommodating diverse needs in highly visual platforms, pointing to a "glaring lack of screen reader compatibility" in many digital whiteboarding tools. This significantly disadvantages BLV team members from collaborating with their teams in early stages of a project.

While these studies have uncovered a wide range of accessibility barriers in mainstream collaborative tools, they often focus on specific tools or domains, and most adopt qualitative methods such as interviews or case studies to understand BLV experiences. Building on this work, our study aims to provide a more comprehensive and cross-cutting understanding of the experiences of BLV professionals across a broader spectrum of work environments.

## 3 Method

Our survey aimed to understand screen reader users' experiences and concerns related to the ease of use of five types of collaborative technologies that are used across many workplaces: videoconferencing, asynchronous messaging, collaborative writing, project management, and digital whiteboard tools.

### 3.1 Recruitment

The survey was administered using Google Forms and was open for six weeks during February and March 2025. We circulated recruitment materials through email lists maintained by the National Federation of the Blind (NFB) [34] and the American Foundation for the Blind (AFB) [2]. We used a two-step process for recruiting and enrolling participants. Interested participants first signed up using a separate Google Form, which we used to check their eligibility. Eligibility criteria included: (1) residing in the United States, (2) age 18 years or older, (3) identify as blind or low vision, (4) primarily use a screen reader for accessing digital content (instead of magnification), (5) speak English, and (6) have experience of using at least one digital collaboration tool. Two researchers screened participants who responded through the sign-up form and then provided a direct survey invitation to each eligible participant. The two-step process helped reduce the likelihood of bots and spam, ensured proper screening of participants, and that each participant could take the survey only once. Each participant who completed the main survey received a $30 Amazon e-gift card for their participation.

### 3.2 Participants

A total of 169 people took the survey. Two researchers manually reviewed all responses and removed respondents who (1) indicated they rely on residual vision to navigate tools rather than primarily a screen reader, (2) reported they were a student but did not have additional work experience, and (3) provided low-quality responses (e.g., no variation in scores, spam-like open-ended responses), or did not complete the survey. We removed 14 respondents in total, resulting in a total sample size of 155 participants.

Roughly 60% of participants ($n = 94$) identified as a woman, 37% ($n = 58$) identified as a man, one person identified as non-binary, and one person preferred not to disclose. The majority of participants were between the ages of 30–49 years ($n = 75, 48.4\%$), followed by 50–64 years ($n = 50, 32.3\%$). More than 75% of respondents had earned their bachelor's degree ($n = 55, 35.5\%$) or a master's degree ($n = 64, 41.3\%$).

Nearly 80% of participants indicated they were employed, whether full-time ($n = 75, 48.4\%$), part-time ($n = 24, 15.5\%$), or self-employed full- or part-time ($n = 24, 15.5\%$). Other participants said they were not currently employed ($n = 15, 9.7\%$), with three saying they were recently employed and one indicating they are due to start a job within the next month. All people who were currently unemployed had work experience and were instructed to reference their prior work experience when completing the survey.

Participants indicated they worked in a wide range of industries, including education ($n = 31, 20\%$), health care and social assistance ($n = 18, 11.6\%$), information technology ($n = 14, 9\%$), and arts, entertainment, and recreation ($n = 7, 4.5\%$). Others said they worked for a nonprofit or foundation ($n = 36, 23.2\%$) or a government agency ($n = 15, 9.7\%$). Around one-third ($n = 52, 33.5\%$) of participants worked in companies where accessibility or disability is the main focus

of their organization. Forty percent of participants $n = 62$ reported that accessibility or disability was the primary focus of their job role. Roughly one quarter of participants $n = 41, 26.5\%$ indicated that they manage teams of people as part of their role. More details about participants can be found in Table 8.

### 3.3 Survey Design and Procedure

Participants provided their consent before participating in the study, which was approved by our institution's ethics review board. Upon agreeing to participate, they answered a standardized set of questions across the five collaborative tool types we considered. The structure included frequency of tool type usage (e.g., How frequently do you use videoconferencing tools for work?), reasons for non-use, and specific tools used for work regardless of individual use (e.g., Which of the following videoconferencing tools are used for your work, regardless of whether you use them?). Within each tool type, we identified specific tools to ask about based on usage data (e.g., [4, 5, 7, 9, 11, 12, 15, 18, 26, 27, 38, 41, 46, 56]) and the O*NET Hot Technology list [36]. Participants could also add specific tools they used through an "other" field.

While the tools asked about in the survey are technically accessible (i.e., meet certain levels of WCAG compliance [53]), our goal was to understand how easily screen reader users could use these tools as part of their work. To assess this, we asked participants, *"As a screen reader user, how would you rate the overall ease of use of the following tools?"* and provided a 10-point Likert scale with the endpoints labeled as "1 = Extremely difficult to use" and "10 = Extremely easy to use." Participants were instructed to enter 0 if they did not use the tool.

For participants who indicated they used a tool type, we asked which specific tool they use most for work. Then participants rated the ease of performing a set of tasks using that tool. We identified common tasks within each tool type by reviewing prior work (e.g., [4, 5, 7, 9, 11, 12, 15, 18, 26, 27, 38, 41, 46, 56]) and visiting the product pages for each tool. As an example, for asynchronous messaging tools we identified and cross-checked common tasks users perform with Slack, Microsoft Teams, Google Chat, Discord, Twist, and Mattermost.

Participants then responded to questions about the perceived impact of technology-related accessibility barriers on their ability to collaborate, their job performance, and their future career prospects. Lastly, demographic information was collected. Survey questions are included as supplementary material.

We conducted detailed pilot testing with two BLV participants who are also accessibility experts. They provided feedback on question wording and checked screen reader access using JAWS, VoiceOver, and NVDA. Although we considered other survey platforms, Google Forms was consistently most accessible across screen readers [47]. To further improve accessibility, all participants were given the option to complete the survey over the phone with a researcher. Seven participants completed the survey by phone.

### 3.4 Data Analysis

We use a combination of non-parametric and parametric approaches in our data analyses, depending on deviation from normality and the variability of residuals. Our two primary dependent variables are: ease of using tools and ease of performing tasks. To analyze our between-subject non-parametric data, we conducted an overall Wilcoxon rank sum test [32] (for two groups), and a Kruskal-Wallis test [24] (for multiple groups). For the Kruskal-Wallis test, we performed Dunn's test of multiple comparisons as the post hoc test using Bonferroni correction. Since we used 10-point Likert scales and averaged multiple Likert responses during the analysis, we chose to treat the Likert items as ordinal approximations of continuous data, a practice supported by existing literature [10, 35]. Therefore, to analyze within-subject data containing multiple groups, we used linear mixed-effects models [55] with fixed slopes and random

intercepts for each participant. We used estimated marginal means to compute all the pairwise comparisons. The p-values were adjusted with the Tukey method [48].

We analyzed open-ended responses regarding specific tools and their features as a way of further understanding and contextualizing closed-ended or numerical responses. To analyze open-ended responses for questions regarding the impact on collaboration, job performance, and career prospects, we using an affinity mapping process [23]. Two researchers iteratively grouped responses based on shared viewpoints and experiences among participants. In reporting their open-ended responses below, we selected participant quotes that capture the breadth of perspectives and experiences.

## 4 Findings

### 4.1 Frequency of Using Collaboration Tools for Work

Across the collaboration tools studied, videoconferencing tools were used by nearly all respondents ($n = 152, 98\%$), followed by asynchronous messaging ($n = 123, 79.4\%$) and collaborative writing tools ($n = 122, 78.7\%$). Fewer numbers of participants reported using project management ($n = 60, 38.7\%$) or digital whiteboarding ($n = 25, 16.1\%$) tools. See Table 3 for more details. No clear statistically significant differences in frequency of use were observed based on participants' organization type (accessibility focused or not), role type (accessibility focused or not), or whether they manage other people. Thus, we present aggregated usage data below.

While all but one participant uses videoconferencing tools for work, nearly 75% ($n = 115$) use them multiple times per week or more, with 40% ($n = 62$) reporting using them for work once a day or more. Participants who did not use videoconferencing tools said they were not necessary for their work. Among these tools, participants reported using Zoom the most for their work ($n = 86, 55.5\%$), followed by Microsoft Teams ($n = 36, 23.2\%$), and Google Meet ($n = 21, 13.5\%$). Half of participants ($n = 78, 50.3\%$) reported using asynchronous messaging tools for work multiple times per week or more. Additionally, one-third of participants ($n = 54, 34.8\%$) indicated they use these tools once per day or more. Among participants who used these tools for work, the majority used Microsoft Teams ($n = 69, 56.6\%$) or Slack ($n = 33, 27\%$) the most. The smaller numbers of participants used Google Chat $n = 13, 10.7\%$ , Discord ($n = 3, 2.5\%$), or Mattermost ($n = 2, 1.6\%$). For collaborative writing tools, 41.1% ($n = 62$) reported using them multiple times per week or more. A smaller subset of participants ($n = 24, 15.9\%$) indicated that they use them several times a day. Among participants who used these tools for work, the majority mentioned using Google Docs ($n = 65, 41.9\%$) or Microsoft Word Online 365 ($n = 52, 33.5\%$) the most. Among the five collaborative tools, respondents used digital whiteboard tools the least. Only 5 people 3.3% using them on a weekly basis or more. Although only 25 respondents said they used digital whiteboards at all, 50 people reported that one or more digital whiteboarding tools are used for their work (i.e., whether they use it or others at their organization do). Among available options, participants reported that their work involved using Zoom Whiteboard ($n = 34, 21.9\%$), Microsoft Whiteboard ($n = 22, 14.2\%$), Miro ($n = 11, 7.1\%$), Mural ($n = 4, 2.6\%$), Stormboard ($n = 3, 2\%$), and Figjam ($n = 3, 2\%$), regardless of whether they use them or not. Among the few participants who mentioned using digital whiteboards, 11 people reported using Zoom Whiteboard (7.1%), followed by Microsoft Whiteboard ($n = 7, 4.5\%$), the most for their work.

Only a few respondents ($n = 24, 15\%$) reported using project management tools for work multiple times per week or more, and only 12 people (8%) reported using them several times a day. Among the participants who used project management tools for work, they reported using Asana ($n = 12, 7.7\%$) the most, followed by Jira ($n = 9, 5.8\%$), Trello

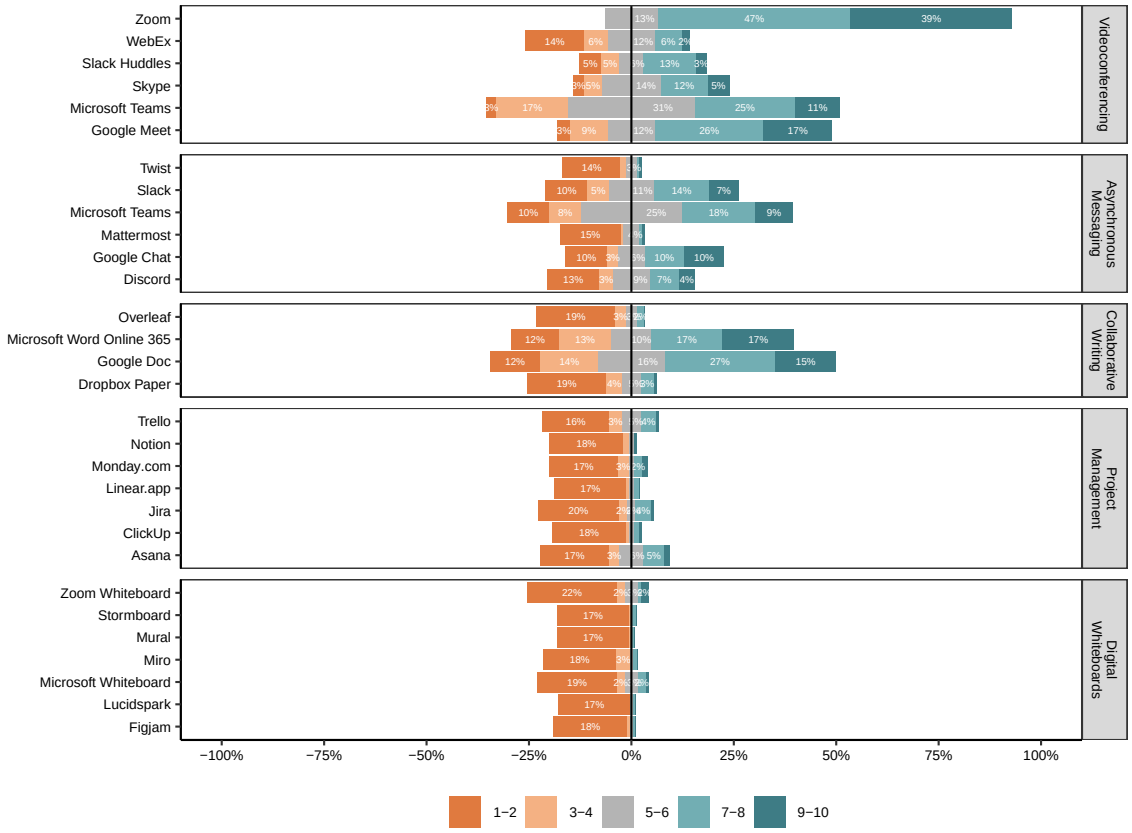


Fig. 1. Percentage ratings for collaboration tool ease of use on a 10-point Likert scale, with 1 being "extremely difficult to use" and 10 being "extremely easy to use." We only report ratings from participants who indicated that they use the specific tool.

($n = 7, 4.5\%$), and Monday.com ($n = 4, 2.6\%$). Further details on participants' experiences with collaborative tools are provided in Table 9.

### 4.2 Ease of Using Collaboration Tools

On the whole, videoconferencing tools were rated as easiest to use $M = 6.51, SD = 2.38$, followed by collaborative writing $M = 5.36, SD = 3.02$ and asynchronous messaging tools $M = 5.22, SD = 3.0$. Project management $M = 3.41, SD = 2.82$ and digital whiteboarding tools $M = 3.33, SD = 3.03$ received comparatively lower ease of use ratings. Prior work has emphasized that many of these technologies have a steep learning curve for screen reader users [4, 15, 19, 27]. When examining ease of use scores among people who use various tool types frequently (weekly or more) versus less frequently (monthly or less), Wilcoxon rank-sum tests indicate significant differences in ratings for collaborative writing $W = 11086, p < 0.01$, project management $W = 4331.5, p < 0.001$, and whiteboarding tools $W = 779.5, p < 0.001$. That is, participants who use these type of tools frequently (weekly or more) for work perceived them as relatively easier to use compared to those who use them less often. We now detail the ease of use within each type of collaboration tool as well as the extent to which these tools support screen reader users in performing core

collaborative tasks. We also present a summary of the accessibility barriers identified in our qualitative findings in Table 7.

*4.2.1 Videoconferencing Tools.* We conducted a linear mixed effects model and found significant differences in ease of use across videoconferencing tools $F = 48.92, p < 0.0001$. Tukey post-hoc pairwise comparisons revealed that Zoom $M = 8.1, SD = 1.37$ was rated significantly easier to use than all other videoconferencing tools all $p < .0001$. Google Meet $M = 6.8, SD = 2.3$ was the second highest rated for ease of use and was significantly easier to use than Microsoft Teams $t = 3.260, p < 0.05$, Slack Huddles $t = 3.784, p < 0.01$, and WebEx $t = 8.831, p < 0.0001$. However, WebEx $M = 4.3, SD = 2.53$ was rated as significantly less easy to use compared to other videoconferencing tools (all $p < 0.001$).

Participants' open-ended responses elaborate on Zoom's ease of use for screen reader users. Respondents said Zoom has "clear audio, easy navigation, labeled buttons, useful hotkeys, customizable alerts" and Zoom is "streamlined for people to use on all of their devices, including land lines, cell phones, tablets, and laptop/desktops." Other videoconferencing tools were appreciated for their interoperability with other tools, such as how Google Meet synchronizes with Google Calendar and Microsoft Teams synchronizes with Outlook. Three people commented on the benefits of having consistent keyboard shortcuts across Microsoft products. They explained this consistency makes Microsoft Teams easier to use, as learning new sets of keyboard shortcuts is often cognitively taxing and time-intensive [4, 26, 27]. Some respondents indicated that the tool they prefer most (Zoom) is not the tool they use most for work. In particular, 27 people said they use Microsoft Teams most for work but prefer Zoom, often explaining that Zoom's key commands were more intuitive and easier to remember and that updates do not break accessibility [26, 27]. Multiple respondents shared that regular updates to Microsoft Teams change how it works, leading to frustration.

We conducted a Kruskal-Wallis test to compare ratings for the ease of doing specific tasks for specific features across three videoconferencing tools: Zoom, Google Meet, and Microsoft Teams and observed significant differences $\chi^2 = 37.194, p < 0.0001$ [1]. When we examine which features were easiest for people to use across platforms, participants rated all but one feature as easiest to perform in Zoom (Table 4). Our pairwise comparisons revealed that participants rated the ease of completing all tasks except monitoring chats with Zoom significantly higher than Microsoft Teams all $p < 0.05$. However, we did not observe any overall significant differences in performing the tasks using Zoom and Google Meet $p > 0.05$ or between Google Meet and Microsoft Teams $p > 0.05$. While Google Meet has slightly better ratings for ease of understanding what is displayed when others screen share, the difference is not significant compared to Zoom, and is difficult to interpret because multiple respondents said they rely on colleagues to verbalize what is being shared, potentially skewing their responses. Table 4 presents the average ease-of-use ratings for specific features across the videoconferencing tools evaluated.

Participants' opened-ended responses help contextualize their experience with specific features. Several people commented on the difficulties of interacting with the chat feature in Zoom, such as keeping up with conversations, accessing posted links, and jumping between messages [26, 27]. Others mentioned the difficulty of knowing who is in the meeting [4, 26, 27], specially in large meetings. On the whole, respondents reported concerns with screen sharing and wanted ways to make knowing what is being shared more accessible, which echo earlier work [4, 11, 27, 46].

*4.2.2 Asynchronous Messaging Tools.* Our linear mixed effects model revealed overall significant differences in ease of use across asynchronous messaging tools $F = 13.94, p < 0.0001$. However, the pairwise comparisons indicated no

[1]The survey asked participants to indicate the tool they used most for work and then asked them to complete task-level ease of doing ratings only for that specific tool. To facilitate task-level comparisons across tools, we only report results from tools that received 20 or more responses from participants.

significant differences between the top four rated asynchronous messaging tools: Google Chat $M = 5.96, SD = 3.16$, Microsoft Teams $M = 5.95, SD = 2.55$, Slack $M = 5.89, SD = 2.81$, and Discord $M = 5.06, SD = 2.84$, all $p > 0.05$. In contrast, Mattermost $M = 2.64, SD = 2.57$ and Twist $M = 2.38, SD = 2.30$ were rated significantly less easy to use than all other asynchronous messaging tools, all $p < 0.01$.

Regarding the top three tools, participants had various positive comments regarding each platform. One person said, "Google chat is more user-friendly and easy to use. I can navigate to various conversations easier. I also enjoy the group chats within the chat forum. They are easy to create and participate in." Regarding Slack, another person said, "I enjoy using Slack because of ease of use and the ability to look up information very easily." Another commented on Microsoft Teams, "I guess I'm using [Microsoft] Teams for almost five years now, so I'm used to it and I can quickly navigate with ease." In contrast to these positive comments, several respondents $n = 12$ said they did not like any of the asynchronous messaging tools but were required to use these tools for work. One person said, "I avoid them as much as I can, benefits of owning my own business. I have a strong dislike for all of them and prefer email."

When evaluating the ease of use of various features across asynchronous messaging platforms, we compare Slack to Microsoft Teams, again only performing task-level comparisons for tools that were indicated as used most by 20 or more participants. Wilcoxon rank-sum tests revealed significant differences in overall task-level ratings between Slack and Microsoft Teams $W = 43442, p < 0.001$, with higher ease of performing multiple tasks on Slack compared to Microsoft Teams (see Table 5). While Slack consistently performed better than Microsoft Teams among specific features, participants reported significantly greater ease in editing or deleting messages in Slack compared to Microsoft Teams $W = 742, p < 0.05$. They also found reacting to messages with emojis to be significantly easier in Slack $W = 743.5, p < 0.05$. However, no significant differences were observed between the two tools for other tasks $p > 0.05$.

Multiple participants commented on the distracting nature of message notifications when using a screen reader [26, 27]. One person said, "I worked in a group of 40+ people and it was really distracting when someone was sending chats and emojis and I was trying to read something. I kept losing my place." Participants reported mixed experiences with learning to navigate the organization of messages across channels and threads. From a positive perspective, one person said, "Slack is simple to navigate and understand, with its channels, threads, and direct messages keeping conversations well-organized." Others, in contrast, described difficulty finding information across channels and threads, particularly with Microsoft Teams. One person said, "I can almost never find the threads I'm looking for in channels, and reading through an entire thread is really frustrating as I seem to always need to select a reply in order to read the whole thing, then go back to the original thread, navigate through the many many buttons it contains, and then find the next reply. I do not enjoy it." In terms of leaving reactions, one person explained regarding Microsoft Teams, "I do struggle leaving reactions that are what I am trying to click, sometimes leaving random reactions." In contrast, one person said of Slack, "I like how you can react with the same symbol as someone else already did. However, it takes a while to get to the additional symbols. I'd love if I can swipe up or down and it would provide me an option like: react with thumbs up. This would make sense since it shows that you have agreed and seen an important message while remaining professional." As this person indicates, being able to leave an appropriate reaction is part of acknowledging others on a team and being professional. Several participants mentioned wanting better support for image captioning or alt-text and that regular software updates can negatively affect their experience, echoing prior work with other types of tools [4, 15].

*4.2.3 Collaborative Writing Tools.* Regarding ease of use, overall, the linear mixed effects model indicated significant differences between collaborative writing tools $F = 29.41, p < 0.0001$. The pairwise comparisons indicated no significant differences ($p > 0.05$) between the top two collaborative writing tools, Google Docs $M = 6.21, SD = 2.51$ and Microsoft Word Online 365 $M = 6.18, SD = 2.90$. However, both Google Docs and Microsoft Word Online 365 were rated significantly easier to use than Dropbox $M = 3.18, SD = 2.68$ and Overleaf $M = 2.46, SD = 2.40$, all $p < 0.0001$.

While respondents provided similar positive comments regarding Google Docs and Microsoft Word Online 365 (e.g., familiarity, intuitive user experience, focus on accessibility), many open-ended responses suggested more nuanced usage of Google Docs and Microsoft Word Online 365 together. For example, one person explained, "Because I find it [Google Docs] difficult to use, I often have to ask colleagues to send me the document in Word which I can then edit or comment on as needed. This is an extra step that I wish I did not have to take but it is often the only way for me to provide input." Regardless of their specific preference for one tool over another, many respondents mentioned general difficulties using collaborative writing tools. For example, "I don't find any of these tools absolutely easy to use. I seem to have an easier time with Google Doc because it's easy to tell when other people are also working on a document at the same time."

Regarding the ease of using different features of collaborative writing tools, we compare experiences with Google Docs and Microsoft Word Online 365 (more than 20 participants mentioned using them). No significant difference for task-level ratings was observed between them $p > 0.05$. Overall, among the tasks, participants reported that identifying who is actively working in a document $M = 6.33, SD = 3.10$ and making edits with track changes enabled $M = 6.00, SD = 2.98$ are the easiest tasks to perform. The most challenging task for them was calling a collaborator's attention to a particular section $M = 4.87, SD = 2.98$ (details reported in Table 6).

Open-ended responses confirm prior findings regarding the difficulty of using collaborative writing tools among BLV people [7, 15, 56]. Specifically, participants described the difficulty of using comments and track changes features, particularly when navigating between reading comments and finding their place again in the document. One person explained this is particularly difficult with long documents or those with extensive comments: "The experience, even though accessible, is very time consuming. I have to collaborate on docs with 100+ comments and it is so difficult to find new comments as it lists them in order of where they appear in the doc." Affirming earlier work [15, 56], current collaborative writing tools still do not support effective ways of working together synchronously. Multiple participants said challenges of synchronous editing lead to "working offline by passing a document back and forth." Others said they designate specific times to work on a shared document "so my screen reader doesn't jump to other people's edits at random." In summary, collaborative writing tools still present many challenges to BLV people who are using them for real-time collaborative work, and as one person said "The accessibility of all collaborative writing tools must be improved."

*4.2.4 Project Management Tools.* In terms of ease of use, our linear mixed effects model did not reveal any significant differences between the project management tools $p > 0.05$. Therefore, we report the average ease-of-use scores for each tool.

Asana was rated $M = 4.34, SD = 2.86$ as the easiest to use among others. Trello $M = 3.96, SD = 2.63$ was ranked second in usability, followed by Monday.com $M = 3.59, SD = 3.11$, Jira $M = 3.44, SD = 3.0$, ClickUp $M = 2.68, SD = 2.67$, Linear.app $M = 2.41, SD = 2.40$, and finally Notion $M = 2.28, SD = 2.54$. Overall, the results

show low ease-of-use scores for project management tools, suggesting that screen reader users usually find them difficult to use.

Participants' open-ended responses provide further context regarding ease of use. A couple people who used Asana reported that it is "accessible and easy to use with their screen reader" and "there is a bit of a learning curve, and there are some accessibility issues, but I've learned to perform some tasks." More often than not, however, participants expressed concerns that available project management tools are not well designed for screen reader users and are difficult to learn. One person said, "Due to accessibility I have not ever been able to use any of these."

Although not enough participants reported using project management tools to allow for task-level analysis, their open-ended comments provide some insight into what is most difficult about using these tools. One person said, "Asana is horrible. The interface is overly complex with too much information presented. JAWs looses focus constantly when within Asana. Buttons are not clearly labeled and it is very difficult to move from one item to the next in a list." Those who used Jira provided similar comments, such as "It is hard for me to know the actual information and work on it," and "I do not find Jira very accessible or intuitive. It is too cluttered and difficult for me as a screen reader user to maintain orientation on the screen." Thus, even the fundamental task of getting a sense of information within a project management tool can be difficult for screen reader users, let alone using it for more [11, 12, 38, 56]. Some participants expressed a desire to use these tools in their work. One person noted, "Beyond 'accessibility' there is ease of use. I wish there were keyboard shortcuts to memorize to speed things along. Even if I am not [the] project manager, I want to contribute in the overall project management," highlighting how both accessibility and ease of use impact BLV workers' ability to participate.

*4.2.5 Digital Whiteboarding Tools.* Our linear mixed effects model did not reveal any significant differences in ease of use between the digital whiteboarding tools $p > 0.05$. Therefore, we report the average ease of use scores for each tool. Participants rated Zoom Whiteboard $M = 4.37, SD = 3.13$ as the easiest to use among others, followed by Microsoft Whiteboard $M = 4.1, SD = 2.86$, Stormboard $M = 3.13, SD = 2.9$, Miro $M = 2.75, SD = 2.3$, Lucidspark $M = 2.57, SD = 2.70$, Mural $M = 2.17, SD = 2.40$, and FigJam $M = 2.0, SD = 2.14$. While participants, on the whole, were unsatisfied with the ease of use for digital whiteboarding tools, those who used Zoom Whiteboard said it is slightly more accessible than other options, and JAWS speaks certain elements. Respondents who used Microsoft Whiteboard liked that it integrates with the other tools they use (Microsoft Teams), although "it can be tricky to navigate. I often have a sighted person with me to help navigate." Others mentioned using human assistance (e.g., Aira, co-workers). Many other respondents indicated that none are "good" options, saying "they are all inaccessible to me" and "I honestly gave up trying to use them." One person explained, "I haven't yet found one that's very accessible or works well for everyone on my team, so we have stayed away from them so far." Another respondent who indicated that multiple digital whiteboarding tools are used at their work said that the lack of digital whiteboard accessibility "puts blind people at a disadvantage when collaborating with designers."

While not enough participants used digital whiteboards to allow for task-level analysis, their open-ended comments provide some insight into challenges with use, including using the key commands, lack of proper labeling, getting the screen reader to recognize and predictably manipulate items on the board, and accidentally deleting objects. Finally one person said, "As a screen reader user, I found it entirely visual with no meaningful way to interact with or contribute to the content, similar to just putting a graphic or image on the screen. This made it impossible to participate equally with my peers," resonating with prior work [18]. Below we examine the impacts of these tools on collaboration, job performance, and career prospects in more detail.

### 4.3 Perceived Impacts of Technology-Related Accessibility Barriers on Work

In addition to surfacing wide-spread usability issues with collaboration technologies, our findings show that more than half of the participants reported that technology-related accessibility barriers affect their collaboration, job performance, and career growth. We included their detailed responses below to illustrate the diversity of their experiences.

*4.3.1 Impact on Collaboration.* When asked whether technology-related accessibility barriers affect their ability to collaborate, half of respondents ($n = 79, 52.3\%$) said "yes", while 41.7% ($n = 63$) said "no", and 6% ($n = 9$) said "unsure".

Participants who mentioned that accessibility barriers affect their ability to collaborate echoed findings from prior work [4, 5, 7, 11, 15, 18, 26, 30, 38, 46, 56]. Some reported difficulty using required collaboration tools or those commonly used by colleagues (e.g., "They make it hard for me to collaborate with colleagues in other departments who do a lot with Trello, Google Docs, and Slack"). Others noted that accessibility barriers cause delays, reduce efficiency, and hinder real-time collaboration, leaving them feeling left behind (e.g., "I often cannot collaborate in real time, either because things move so quickly, or the technology does not keep up, or it is just inaccessible"). Many responses described how accessibility barriers cause communication and coordination breakdowns, such as not knowing whether colleagues accessed their comments and who made which edits, sorting out conflicting file versions, and being unable to maintain up-to-date information about task status and who is doing what.

Accessibility-barriers also limited their participation in tasks and teamwork, having negative social and professional consequences (e.g., "If I had the option of only using applications that were accessible to me, I could produce amazing work and I would be able to collaborate with my colleagues better and would be seen as much more of a team-player"). Accessibility barriers may mean that their employer has to "call out that I'm exempt from an activity. It hurts." Others shared that when they struggle to use collaboration tools effectively, they are often excluded from projects and unable to keep up or contribute, leaving their colleagues frustrated and disappointed. Some described ways in which accessibility limits their team's use of tools (e.g., "Most of my coworkers are sighted and would really like to use some of these tools. I feel that we are all missing out on products that could benefit our productivity"). While some mentioned that they work at companies that emphasize accessibility, there was still a desire to have access to state-of-the-art collaboration tools but felt they were not even an option.

Participants who responded "no" often said they did not use the aforementioned collaboration tools or were only using tools that were accessible to them (e.g., Zoom). Some people mentioned creating workarounds and learned ways to collaborate effectively, often explaining that they turn to email, text messaging, and phone calls or work together in-person. Being able to control which tools are used at work, as a team lead or business owner, also affected responses, with one person saying this allowed them to "bypass most areas where accessibility is a real headache."

*4.3.2 Impact on Job Performance.* In response to a question on whether technology-related accessibility barriers affect their job performance, nearly two-thirds of participants ($62.6\%, n = 97$) said "yes". The remainder said "no" ($32.3\%, n = 50$) or "unsure" ($5.2\%, n = 8$).

Participants who said accessibility barriers affecting job performance, frequently mentioned reduced efficiency or time related delays that impacted their productivity (e.g., "They don't impact what I can do, but how quickly I can do it." and "Requires me to spend sometimes 2x or 5x extra time on doing the same task"). Some mentioned inefficiencies due to poor user experience (e.g., "Even when a task is technically accessible, the user experience may be poor. This makes completing tasks more time-consuming, mentally exhausting, and inefficient"). Participants also said their performance was impacted by needing to wait for accessibility issues to get resolved, which "directly affects performance" [13].

Inaccessibility can even block some people from starting a task (e.g., "In some cases there are workarounds, but typically inaccessibility causes me to not be able to complete my work or even start it"). Several participants mentioned needing to spend time learning software and figuring out associated changes with software updates, which takes a toll on their productivity [15].

Many participants described accessibility issues affecting their ability to complete their job effectively and engage in all aspects of their work, which impacts performance [12, 18, 38]. One person said, "I'm unable to contribute to my fullest potential and it's demoralizing and marginalizing." Some mentioned that their job performance was affected by accessibility issues that prevented them from having full access to information (e.g., "I never feel that I have the benefit of all of the data that is helpful in managing subordinates and assessing team performance and project quality"). A couple people mentioned that accessibility issues make them prone to mistakes. Still others said that accessibility barriers limit their ability to perform core functions of their role, such as accessing databases essential for social work or processing patient intake forms. In these cases and others, people described the constant need to rely on others rather than being able to complete work independently.

Participants who said technology-related accessibility barriers did not affect their job performance explained that they have necessary accommodations in place or that their employer is supportive of their needs (e.g., "My employer is also blind, so if it does not work for him, he already knows that it will not work for me"). Others described the importance of having flexibility or control in the technology they use for their job or selecting an employer that values accessibility. A couple people explained that the technology they are required to use has been thoroughly tested for accessibility or that they work in an accessibility related role, which inherently involves dealing with accessibility issues.

*4.3.3 Impact on Career Prospects.* When asked whether technology-related accessibility barriers affect their future career prospects, more than half of participants (52.9%, n=82) said "yes". The remainder said "no" (25.8%, n=40) or "unsure" (21.3%, n=33).

Participants who answered "yes" elaborated on their responses in multiple ways. Several people mentioned they would need more technology training and were worried about being proficient at using technologies required for other jobs [4, 12, 18]. Others raised concerns about employers not wanting to spend money on accommodations or not understanding their accessibility needs. Some shared feelings of being limited or trapped in their role (e.g., "I fear looking for new job opportunities" and "Basically when I do find a nice place I feel trapped there because it's so hard to find another job"). Some expressed feelings of being left behind (e.g., "I am afraid that if accessibility does not continue to evolve as fast as technology is doing so I will be left behind." Still others described their career advancement stalling due to inaccessibility (e.g., "If I cannot access current technology, I cannot move up at my job" and "I have definitely not gotten promotions at my current job and definitely do not have a path forward in terms of growth"). Multiple people explained feeling limited by a ceiling of inaccessibility (e.g., "There is no advancement in this job because the technology for higher-level positions is not accessible"). Another person commented, "It's impossible to be promoted if you can't do 'simple tasks' like storyboards." Still others shared experiences of being forced out of the workforce (e.g., "I might retire earlier than I otherwise would because the work environment has become so visually oriented" and "I have been let go so many times due to accessibility").

People who said "no" explained that they are not looking for future work, already work in the field of accessibility, or that the issues would be there with any job. Others expressed optimism regarding the future of accessibility (e.g., "As technology continues evolving, it's going to get more accessible") and their own ability to advocate (e.g., "I think

all it takes is to speak up what one needs to have a successful work experience") and learn to use technology (e.g., "Technology will always be around and I make sure that I am up to date on the newest things happening").

Some participants who responded "unsure" expressed optimism that shifts towards increased accessibility which could present new career opportunities (e.g., "I hope accessibility will become the norm rather than the exception in the future" and "The constant change in assistive tech could open doors to opportunities that I am not currently considering"). However, participants expressed uncertainty regarding where they may work next, what kind of role they might take on (e.g., "I am not sure. There may be jobs out there that I may have the skillset for but may not be accessible"), and/or the technology they would be required to use (e.g., "Technology is always changing; I worry I can't keep up"). Others referenced systemic barriers that shaped their answers (e.g., "Every role in our company is not accessible, but that is due to not having a person who is blind in that role. My next role may be replacing someone who is sighted. With that being said I would have to figure ways to complete tasks that may not be accessible"). Another said, "The organization claims to believe in DEI, but the fact that I take a few moments longer than a sighted person—and the prevailing perception that a 'normal' person is better than someone with a disability—stands out like a sore thumb." Still another explained, "There is already so much disability discrimination in the work world; when applying for many jobs, I feel like I need to be able to say that I can use any technology no matter what it is, no problem, and that just isn't the truth. I am banking on the connections I'm making and my past work to keep me employed going into the future."

Our findings show that the constellation of technologies that are used for, and in many cases required for work, are not only individually difficult to use but also create friction during collaboration, affect job performance, and impact the way people imagine their future careers.

## 5 Discussion

Our results show that—despite extensive research on the challenges of using collaboration tools and associated consequences—digital collaboration tools, on the whole, are still difficult for many screen reader users to use. The point is not just that our findings confirm myriad prior studies, it is that these are still persistent, serious issues for a marginalized group of workers and have real material and social consequences for their livelihood. We synthesize our findings below to show which cross-cutting issues are still persistent, especially given the ongoing and rapid changes made to industry products. We also call attention to areas of need for future work.

### 5.1 Designing for Ease of Access

Previous research has highlighted that software accessibility does not necessarily correspond to ease of use, particularly for screen reader users [4, 15, 26, 27]. Given this important distinction, our study aimed to systematically examine the relative ease of use of 30 digital collaboration tools and common tasks that can be performed using these types of tools. Our participants emphasized that although collaborative platforms often advertise accessibility features, those features are rarely intuitive or easy to use in practice. For example, Zoom, which was rated as the easiest tool overall, was critiqued for its difficult-to-use chat interface that complicates participation during live discussions, confirming findings by Akter et al [4]. More broadly, participants described how usability issues within each of these tools make day-to-day tasks more time-consuming and cognitively demanding [11, 38, 56]. Our findings point to a broader disconnect between technical accessibility and functional usability, highlighting the need to shift from a compliance-based approach to one that prioritizes the lived experience of BLV professionals. Designing for ease of access means not only ensuring screen reader compatibility but also supporting efficient, intuitive workflows that align with the realities of collaborative work.

Our findings suggest that more commonly and frequently used tools, such as videoconferencing and asynchronous messaging tools, are rated as relatively easier to use than other tools in our study. This trend suggests that, despite initial usability hurdles, increased exposure and usage may help users develop workarounds or mental models to navigate these tools more effectively [4, 15]. Although repeated interaction with these tools can lead to greater fluency, it does not eliminate the underlying difficulties. We interpret this result cautiously, as it has the potential to mask the long-term learning of myriad keyboard shortcuts and accumulation of workaround strategies that lead to easier use. For many users, this means that the ease of use is not inherent to the tool but the result of extensive learning and adaptation work performed behind the scenes. In contrast, tools that are used less frequently, such as project management and digital whiteboarding platforms, remain persistently difficult to use. Participants who reported that these tools are used for their work, but that they do not use them, suggested it is due to both inaccessibility and their steep learning curve. These tools are designed in ways that prioritize visual interaction paradigms and lack support for non-visual workflows, further discouraging BLV users from engaging with them and reinforcing cycles of exclusion in early-stage planning and coordination tasks. Therefore, collaborative tools should be inherently intuitive, designed to support non-visual workflows, and minimize the need for extensive shortcut memorization, ensuring they are usable from the outset rather than relying on repeated use or user-created workarounds.

The visual-centric nature of many collaborative tasks, such as screen sharing in videoconferencing platforms, edits and comments in collaborative writing tools, project management timelines and charts, and the arrangement of objects and text on a digital whiteboard—further complicate ease of access for screen reader users [4, 11, 12, 18, 38, 56]. Participants described difficulty in identifying changes made by collaborators and accessing key information communicated through color-coding, highlighting, or spatial arrangement in collaborative writing tools. Additionally, project management tools like Asana and Jira were frequently cited as "overly complex" and "cluttered," with poor screen reader support, such as unlabeled interface elements, and inconsistent navigation that made it difficult to track tasks or interact with team members. Similarly, digital whiteboards were described as fundamentally inaccessible, offering little to no support for non-visual interaction. These tools, which play a central role in collaborative planning and ideation, often exclude BLV professionals by design [18]. The lack of meaningful text-based alternatives, semantic structure, or screen reader-friendly navigation reinforces a visual bias that prioritizes sighted workflows and overlooks the needs of screen reader users. This often leads to passive participation or a communication and coordination breakdown. These findings highlight the urgent need to reimagine collaborative tool design in ways that support multimodal interaction and foster inclusive participation for all team members. One likely reason is that accessibility compliance may be checked at the feature level (e.g., button labeling, keyboard navigation) rather than ensuring higher level tasks required for efficient and meaningful use are supported. That is, these tools are far from helping screen reader users efficiently and effectively maintain a sense of which collaborators have made critical edits to a document, track the state of multiple projects and contingencies, and know how information relates because of its spatial proximity (e.g., digital sticky notes placed next to each other). Underlying accessibility is essential, but it is not the whole story.

Beyond visual-centric interaction paradigms, the scalability of collaborative tools poses another layer of complexity. As the number of interactions, messages, or document elements increases, so too does the cognitive load for screen reader users [4, 7, 9, 12, 15, 26, 27]. Participants noted that in large virtual meetings, constant announcements of user activity (e.g., joining or leaving) disrupt the listening experience and make it difficult to focus on the presenter. In asynchronous messaging environments, frequent message and emoji notifications further interrupted task flow, causing users to lose their place or miss important information. Similarly, navigating long documents or documents with extensive comments often requires screen reader users to spend considerable time locating and reviewing relevant

information, especially when collaborative features like threaded comments are not optimally designed for non-visual interaction, a concern reported in prior research [15–17]. These usability issues highlight that accessibility is not only a matter of basic compliance but also of thoughtful, scalable interaction design. For screen reader users to participate equitably, collaborative tools must address both the visual nature of key features and the layered complexity that arises in dynamic, content-rich work environments.

### 5.2 Compounding Effects on Job Performance and Career Advancement

The inaccessibility and difficulty in using digital collaboration tools has a compounding effect on BLV people in the workplace [4, 12, 18, 38, 51]. Over half of the participants in our study reported that limited access to collaboration tools negatively affects their job performance, career advancement, and ability to collaborate effectively with sighted peers, often by reducing efficiency, increasing task completion time, or altogether preventing participation in essential work-related activities [11]. In many cases, participants described needing to spend double or even quintuple the amount of time their peers spend to complete the same task, due to poor screen reader compatibility, unintuitive or overly cluttered interfaces, or inaccessible documentation formats [18]. These barriers can also lead to an increased likelihood of errors, especially when navigating complex systems or working under time pressure. Time-related burdens not only diminish productivity for BLV professionals but also contribute to greater cognitive and emotional strain. Frequent software updates and a lack of clear, accessible training materials further exacerbate the burden, requiring BLV professionals to invest additional effort in learning and adapting to changes without organizational support [4, 54]. These experiences align with the concept of the invisible labor of access [7, 8], where BLV workers must engage in ongoing, behind-the-scenes technical and emotional work to remain productive in environments not designed with their needs in mind. The inability to use tools independently often necessitates relying on colleagues for support, which can unintentionally reinforce negative perceptions about competence and autonomy, if not penalized for lack of individuality in work [4, 11, 12, 15, 18, 38]. As a result, many participants described feeling sidelined from core team activities, unable to fully contribute or keep pace with the flow of collaboration, particularly in environments that demand real-time interaction. These barriers not only hinder individual participation but can also limit team productivity, as some teams forgo using potentially beneficial tools entirely to avoid excluding their BLV members.

Beyond immediate impacts on daily work, participants raised concerns about long-term career growth. Some described being unable to pursue promotions or leadership roles due to inaccessible technologies required at higher levels of responsibility [12, 18]. Others indicated feeling constrained in their current positions out of fear that future workplaces may not provide the accessibility support they need. In more severe cases, participants reported leaving or being pushed out of the workforce entirely due to increasingly visual work environments. The cumulative effects of these barriers—reduced performance, social exclusion, and stalled career advancement—reflect a broader structural inequity in how technology shapes opportunities for BLV workers. These insights underscore the urgent need for companies to build collaborative tools that move beyond minimum compliance standards and enable ease of access, which affects team participation, career mobility, and long-term workplace success.

Our findings highlight the critical role of organizational support in mitigating the impact of inaccessible collaboration tools for BLV professionals. Participants who reported fewer negative effects on their job performance or career advancement often worked in environments where accessibility was prioritized, whether through formal accommodations, leadership that understood accessibility needs, or the ability to choose which tools to use. These supportive settings enabled participants to bypass or work around inaccessible technologies more effectively, often relying on alternative communication methods, such as email or direct conversation, instead of project management tools. Although our

quantitative analyses did not identify significant associations between accessibility-focused workplaces or roles and the reported impact on job performance, collaboration, or career prospects, our qualitative findings suggest a more nuanced dynamic. Several participants described intentionally seeking out employers who "prioritize" accessibility or pursuing roles where accessibility was an integral aspect of the work itself, such as advocacy, accessibility consulting, or technology evaluation for accessibility. These strategies allowed participants to maintain greater control over their workflows and avoid reliance on tools with inaccessible or overly visual interfaces.

However, such support was not universal. Many participants reported being required to use tools like Microsoft Teams, Trello, or Asana despite usability issues, with little room to negotiate alternatives, similar to prior works [4, 11, 15, 18, 38]. Required use of these tools often left BLV users unable to participate effectively or perform core job functions, especially when alternative formats or screen reader-friendly options were not available. In more extreme cases, participants described entire job responsibilities, such as managing databases or handling client documentation, as being fundamentally inaccessible, leading to a diminished sense of purpose and belonging in the workplace. Even in organizations that claim to support diversity, equity, and inclusion (DEI), participants noted a disconnect between stated values and actual practices, especially when their needs were not fully understood or performance was measured by speed of task completion. These experiences reaffirm that supporting access must go beyond individual accommodations and instead involve systemic, proactive efforts to create an inclusive workplace. This includes thoroughly testing new tools for accessibility before adoption, fostering a workplace culture that values inclusive collaboration, and involving BLV employees in decision-making around tool selection and workflow design. Ultimately, the burden of accessibility should not fall solely on the individual; instead, organizations must take an active role in ensuring that all employees have the tools and support they need to thrive.

## 6 Limitations

We recognize several limitations in our study that present opportunities for future research. First, while our sample size is relatively large compared to other recent studies on collaborative tools [4, 15, 18, 19, 46], it remains limited to participants recruited through a few U.S.-based organizations for BLV people and those who voluntarily responded to our recruitment efforts. As a result, the generalizability of our findings to the broader population of BLV professionals may be limited. Reaching this population remains a known challenge [31], and future work should explore additional recruitment strategies to ensure more diverse representation.

Additionally, our analysis focused on five categories of collaborative tools. While these categories reflect core components of modern teamwork, future work should broaden the scope to include other commonly used platforms such as shared calendars, task schedulers, and file-sharing systems. Our sample also included relatively few participants with extensive experience using project management and digital whiteboarding tools, limiting our ability to fully explore barriers specific to these platforms. Recruiting participants with higher familiarity with these tools will be critical for advancing tool-specific design recommendations. Next, we had a small number of respondents in managerial or leadership roles. Some of our qualitative findings suggest that accessibility barriers may affect professionals in these roles differently, particularly with respect to real-time collaboration, project oversight, and team coordination. Future studies should investigate the unique challenges and strategies of BLV professionals in supervisory positions to better support inclusive leadership in collaborative work environments. Moreover, our findings indicated that participants frequently developed workarounds to navigate accessibility barriers of collaboration tools. However, it remained unclear whether the technologies themselves also improved in accessibility over time. Since we did not examine this distinction explicitly, we suggest that future research should investigate this nuance more thoroughly. Finally, due

to the large number of tools analyzed and the feature-specific nature of potential improvements, we did not include detailed recommendations for each tool within this paper.

## 7 Conclusion

To systematically understand the challenges associated with digital collaboration tools, we conducted an online survey with 155 BLV professionals, evaluating the ease of use across five widely-used tool types: videoconferencing, asynchronous messaging, collaborative writing, project management, and digital whiteboards. Our findings reinforced known accessibility barriers for screen reader users while also revealing new challenges. While videoconferencing tools, particularly Zoom, were the most frequently used and considered the easiest to navigate, project management and digital whiteboards were rated as highly difficult to use. More than half of the participants reported that these accessibility barriers negatively impacted their job performance, career advancement, and ability to effectively collaborate with colleagues. Our findings highlight the need for a shift in how collaboration technologies are designed—moving beyond compliance-focused solutions toward approaches that prioritize usability, scalability, and inclusive design.

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## A Appendix

| Paper | Method | Context | Video-conf | Async Msg | Writ-ing | Proj Mgmt | Dig Wtbd | Collaborative Tools Mentioned |
|---|---|---|---|---|---|---|---|---|
| Schoeberlein & Wang, 2012 [41] | Usability study with BLV (N=5) and sighted (N=7) | Accessibility & usability evaluation | | | ✓ | | | Google Docs, Microsoft Word |
| Buzzi et al., 2014 [9] | Inspection with screen reader by all authors | Accessibility & usability evaluation | | | ✓ | | | Google Docs |
| Branham & Kane, 2015 [7] | Field studies BLV (N=5) & sighted (N=6) coworkers | Co-located workplace collaboration | | | ✓ | | | Microsoft Word, Excel |
| Das et al., 2019 [15] | Interviews (N=20) BLV | Collaborative writing | | | ✓ | | | Google Docs, Overleaf |
| Tang, 2021 [46] | Interviews (N=20, incl. 7 BLV) | Remote work | ✓ | ✓ | ✓ | | | Teams, Slack, Webex, Zoom, Google Docs, MS Word |
| Pandey et al., 2021 [38] | Interviews (N=22) BLV programmers | Software Development | ✓ | ✓ | | ✓ | | Jira, Teams, Skype, Slack |
| Leporini et al., 2021 [26] | Walkthrough & Survey (N=29) BLV | Accessibility & usability evaluation | ✓ | | | | | Meet, Teams, Zoom |
| Mack et al., 2021 [30] | Mixed ability auto-ethnography | Remote work | ✓ | ✓ | | | | Microsoft Teams |
| Leporini et al., 2023 [27] | Survey (N=159) BLV | Accessibility & usability evaluation | ✓ | | | | | Zoom, Meet, Teams |
| Yildiz & Subasi, 2023 [56] | Interviews (N=10, incl. 3 BLV) | Remote work | ✓ | ✓ | ✓ | ✓ | | Asana, Docs, Drive, Miro, Zoom |
| Alharbi et al., 2023 [5] | Interviews (N=21, incl. 7 BLV) | Hybrid Work | ✓ | | | | | Teams, Webex, Zoom, Meet |
| Akter et al., 2023 [4] | Interviews (N=18) | Virtual meetings | ✓ | | | | | Zoom, Meet, Discord |
| Das et al., 2024 [18] | Interviews & forum analysis | Collaborative ideation | | | | | ✓ | FigJam, Miro, Jamboard |
| Cha et al., 2024 [11] | Interviews (N=26) BLV | Software Development | ✓ | ✓ | | ✓ | ✓ | Zoom, MS Teams, Jira, Miro, LucidChart, Rally |
| Cha et al., 2024 [12] | Interviews (N=26) BLV | Software Development | ✓ | | | ✓ | ✓ | Jira, Trello, Miro, LucidChart |

Table 1. Overview of studies examining collaborative workplace technologies for BLV professionals

| Tool Type | Once per day or more | A few times in a week | A few times in a month | A few times in a year or less | Never |
|---|---|---|---|---|---|
| Videoconferencing Tools | 62 | 53 | 28 | 11 | 1 |
| Asynchronous Messaging Tools | 54 | 24 | 27 | 22 | 28 |
| Collaborative Writing Tools | 32 | 32 | 34 | 30 | 27 |
| Project Management Tools | 14 | 11 | 14 | 22 | 94 |
| Digital Whiteboard Tools | 2 | 3 | 5 | 16 | 129 |

Table 3. Frequency of using collaborative work technologies.

| Videoconferencing Task | Zoom *M*, *SD* | Google Meet *M*, *SD* | Microsoft Teams *M*, *SD* | Overall Average *M*, *SD* |
|---|---|---|---|---|
| Knowing your own microphone status | [**8.90**], 1.5 | 7.86, 2.2 | 7.5, 2.7 | 8.39, 2.1 |
| Knowing your own camera status | [**8.5**], 1.9 | 7.81, 1.8 | 7.03, 3.0 | 8.03, 2.3 |
| Monitoring messages in the chat | [**6.20**], 2.5 | 6.10, 2.5 | 5.31, 3.1 | 5.96, 2.7 |
| Knowing who is in the meeting | [**7.70**], 2.2 | 6.60, 2.4 | 5.75, 2.8 | 7.05, 2.5 |
| Sharing your screen with others | [**7.77**], 2.1 | 6.30, 2.4 | 5.24, 3.1 | 6.91, 2.6 |
| Knowing what is displayed when others screen share | 3.65, 3.1 | [**4.90**], 3.5 | 2.20, 2.0 | 3.47, 3.0 |

Table 4. Videoconferencing tool average ease of use ratings for specific tasks on a 10-point Likert-style scale, with 1 being "extremely difficult to perform" and 10 being "extremely easy to perform." We only report ratings from participants who indicated that they use the specific tool. Highest values for each task are indicated by square brackets with bold font.

| Asynchronous Messaging Task | Slack *M*, *SD* | Microsoft Teams *M*, *SD* | Overall Average *M*, *SD* |
|---|---|---|---|
| Knowing who is actively using the tool at any moment in time | **[6.36]**, 3.1 | 5.71, 3.2 | 5.91, 3.2 |
| Sending direct messages to specific people | **[7.76]**, 2.4 | 7.46, 2.4 | 7.56, 2.4 |
| Knowing when there are new direct or group messages | **[7.27]**, 2.6 | 7.16, 2.9 | 7.20, 2.8 |
| Creating a new channel or group chat | **[6.52]**, 3.2 | 5.72, 3.0 | 5.97, 3.1 |
| Editing or deleting a message you posted | **[6.94]**, 3.3 | 5.54, 3.0 | 5.98, 3.2 |
| Knowing who else is in a specific group chat | **[7.39]**, 2.5 | 6.36, 2.7 | 6.70, 2.7 |
| Reacting to a message using emojis | **[7.33]**, 2.6 | 6.0, 3.0 | 6.41, 2.9 |

Table 5. Asynchronous messaging tool average ease of use ratings for specific tasks on a 10-point Likert-scale, with 1 being "extremely difficult to perform" and 10 being "extremely easy to perform." Highest values for each task are in square brackets with bold font.

| Collaborative Writing Task | Google Docs *M*, *SD* | Microsoft Word Online 365 *M*, *SD* | Overall Average *M*, *SD* |
|---|---|---|---|
| Making edits with track changes on | 5.74, 2.9 | **[6.33]**, 3.1 | 6.0, 3.0 |
| Understanding who edited which parts of the document | 5.33, 3.1 | **[5.43]**, 3.1 | 5.37, 3.1 |
| Knowing who is actively working in a document | **[6.56]**, 3.2 | 6.06, 3.0 | 6.33, 3.1 |
| Knowing where your collaborators are actively working in a document | **[5.59]**, 3.4 | 5.31, 3.1 | 5.47, 3.3 |
| Commenting on and replying to specific sections of the document | 5.30, 3.1 | **[5.67]**, 3.1 | 5.47, 3.1 |
| Reviewing comments made by others | **[5.82]**, 2.9 | 5.69, 3.0 | 5.76, 2.9 |
| Calling a collaborator's attention to part of a document | 4.79, 3.0 | **[4.96]**, 3.0 | 4.87, 3.0 |

Table 6. Collaborative writing tools average ease of use ratings for specific tasks on a 10-point Likert-scale, with 1 being "extremely difficult to perform" and 10 being "extremely easy to perform." Highest values for each task are in square brackets with bold font.

| Tool-type | Accessibility Barriers |
|---|---|
| Videoconferencing Tools | Challenges accessing chat during meetings<br>Difficulty knowing who is present in meeting<br>Inaccessible screen sharing functionality |
| Asynchronous Messaging Tools | Notification overload<br>Disorganized navigation of threads and channels<br>Inaccessible reaction features<br>Limited support for images |
| Collaborative Writing Tools | Difficulty navigating comments and tracking changes<br>Challenges with synchronous editing |
| Project Management Tools | Overly complex and cluttered interfaces<br>Lack of keyboard navigation and shortcut support |
| Digital Whiteboarding Tools | Lack of non-visual interaction and meaningful access |
| Across multiple tool types | Disruptive software updates<br>Steep learning curve |

Table 7. Summary of accessibility barriers from qualitative findings

| | Total Participants | Percent of Sample |
|---|---|---|
| **Age** | | |
| 18 to 29 | 15 | 9.7% |
| 30 to 49 | 75 | 48.4% |
| 50 to 64 | 50 | 32.3% |
| 65 and older | 11 | 7.1% |
| **Gender** | | |
| Woman | 94 | 60.6% |
| Man | 58 | 37.4% |
| Non-binary | 1 | 0.6% |
| Prefer not to disclose | 1 | 0.6% |
| **Race/Ethnicity** | | |
| White | 120 | 77.4% |
| Asian | 16 | 10.3% |
| Black or African American | 16 | 10.3% |
| Native American or Alaska Native | 3 | 1.9% |
| Other | 7 | 4.5 |
| **Hispanic or Latino** | | |
| Yes | 15 | 9.7% |
| **Employment** | | |
| Employed full-time | 75 | 48.4% |
| Employed part-time | 24 | 15.5% |
| Self-employed (full or part-time) | 24 | 15.5% |
| Student | 5 | 3.2% |
| Retired | 5 | 3.2% |
| Volunteer | 3 | 1.9% |
| Not employed | 15 | 9.7% |
| **Industry Type** | | |
| Nonprofit or foundation | 36 | 23.2% |
| Education | 31 | 20.0% |
| Health Care and Social Assistance | 18 | 11.6% |
| Government agency | 15 | 9.7% |
| Information Technology | 14 | 9.0% |
| Arts, Entertainment, and Recreation | 7 | 4.5% |
| Manufacturing | 3 | 1.9% |
| Service industry (e.g., retail, food service) | 3 | 1.9% |
| Finance | 2 | 1.3% |
| Legal services | 1 | 0.6% |
| Other | | |
| **Accessibility or Disability Focused Company** | | |
| Yes | 52 | 33.5% |
| No | 97 | 62.6% |
| Unsure | 6 | 3.9% |
| **Accessibility or Disability Focused Role** | | |
| Yes | 62 | 40.0% |
| No | 91 | 58.7% |
| Unsure | 2 | 1.3% |
| **Manages Teams of People** | | |
| Yes | 41 | 26.5% |
| No | 111 | 71.6% |
| Unsure | 3 | 1.9% |

Table 8. Demographics of the participants

| | **Used at Workplace** *N, %* | **Preferred Tool** *N, %* | **Overall Ease of Use** *M, SD* |
|---|---|---|---|
| **Videoconferencing Tools** | | | |
| Zoom | 141 (91%) | 118 (76.1%) | 8.1, 1.4 |
| Microsoft Teams | 113 (72.9%) | 13 (8.4%) | 6.1, 2.1 |
| Google Meet | 80 (51.6%) | 1 (0.7%) | 6.8, 2.3 |
| Skype | 19 (12.3%) | 2 (1.3%) | 6.2, 2.3 |
| WebEx | 32 (20.6%) | 1 (0.7%) | 4.3, 2.5 |
| Slack Huddle | 25 (16.1%) | 2 (1.3%) | 5.6, 2.6 |
| **Asychronous Messaging Tools** | | | |
| Microsoft Teams | 90 (58.1%) | 52 (33.5%) | 5.9, 2.6 |
| Slack | 47 (30.3%) | 33 (21.3%) | 5.9, 2.8 |
| GoogleChat | 30 (19.4%) | 17 (11%) | 6.0, 3.2 |
| Discord | 18 (11.6%) | 6 (3.9%) | 5.1, 2.8 |
| Twist | 2 (1.3%) | - | 2.4, 2.3 |
| Mattermost | 4 (2.6%) | 1 (0.7%) | 2.6, 2.6 |
| **Project Management Tools** | | | |
| Asana | 20 (12.9%) | 8 (5.2%) | 4.3, 2.9 |
| Trello | 17 (11%) | 7 (4.5%) | 4.0, 2.6 |
| Jira | 16 (10.3%) | 7 (4.5%) | 3.5, 3.0 |
| Monday.com | 10 (6.5%) | 4 (2.6%) | 3.6, 3.1 |
| Linear.app | - | - | 2.4, 2.4 |
| Notion | 3 (1.9%) | 1 (0.7%) | 2.3, 2.5 |
| ClickUp | 3 (1.9%) | 1 (0.7%) | 2.7, 2.7 |
| **Collaborative Writing Tools** | | | |
| Google Doc | 105 (67.7%) | 65 (42%) | 6.2, 2.6 |
| Microsoft Word Online 365 | 85 (54.8%) | 50 (32.3%) | 6.1, 2.9 |
| Overleaf | 3 (1.9%) | - | 2.4, 2.4 |
| Dropbox paper | 11 (7.1%) | 2 (1.3%) | 3.1, 2.7 |
| **Digital Whiteboarding Tools** | | | |
| Zoom Whiteboard | 35 (22.6%) | 9 (5.8%) | 4.4, 3.1 |
| Microsoft Whiteboard | 22 (14.2%) | 6 (3.9%) | 4.1, 2.9 |
| Miro | 11 (7.1%) | 1 (0.7%) | 2.8, 2.3 |
| Mural | 4 (2.6%) | - | 2.2, 2.4 |
| Stormboard | 3 (1.9%) | - | 3.1, 2.9 |
| Figjam | 4 (2.6%) | - | 2.0, 2.1 |
| Lucidspark | 1 (0.7%) | - | 2.6, 2.7 |

Table 9. Participants' overall use of digital collaborative tools.