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ACCESSIBLE SKILLED TRADES:
INCLUSIVE AND ACCESSIBLE SKILLED TRADES EMPLOYMENT FOR PEOPLE WITH DISABILITIES

Research Report | April 2026

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This report was written by Drs. Katherine Bishop-Williams, Marcus Yung, and Amin Yazdani, and Nicki Islic. Individual chapter authorship is listed on the title page of each report section.

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Executive Summary

Introduction

Skilled trades are fundamental to the functioning and growth of Canada's economy. Workers in trades occupations build infrastructure, maintain essential services, and support industries ranging from construction and manufacturing to transportation and service sectors. The skilled trades may represent a promising pathway toward equitable employment outcomes for persons with disabilities. Skilled trades careers can provide stable employment, strong earnings potential, and opportunities for advancement. Despite this potential, persons with disabilities remain underrepresented in skilled trades occupations.

Research across sectors has documented discrimination in hiring practices, limited opportunities for advancement, and insufficient knowledge among employers regarding disability accommodation. Individuals with disabilities frequently report encountering stigma, aesthetic bias, and skepticism about their productivity or qualifications. In skilled trades environments, these barriers are often amplified by the nature of work tasks and workplace cultures. Trades workplaces often prioritize physical performance, technical skill, and productivity, which can shape assumptions about workers' abilities and influence access to opportunities.

This report addresses knowledge gaps by examining accessibility in skilled trades from multiple complementary perspectives: workers, employers, and previous scientific studies. The projects presented in this report explore employer readiness to accommodate workers with disabilities, the availability of assistive devices, technologies and workplace support solutions, and the lived experiences of persons with disabilities navigating skilled trades employment pathways. Studies contained in this report employ complementary mixed-methods, including phenomenological interviewing, surveys, scoping reviews and environmental scans.

Collectively, these findings have direct implications for the development of accessibility standards that reflect the operational, cultural, and safety realities of skilled trades environments.

Summary of Findings

The research in this report converges on a clear message: persons with disabilities are a significant, underutilized talent pool for Canada's skilled trades, yet face layered structural, cultural, training, and equipment barriers. Practical, scalable solutions, particularly in training design, PPE and procurement, accommodation pathways, and employer readiness, can meaningfully improve sector entry, safety, and retention.

Participation & Risk

Persons with disabilities represent about 20% of apprenticeship populations, but remain underrepresented in the broader trades workforce and advancement pathways, across a variety of sources.

Apprentices with disabilities reported lower occupational health and safety knowledge, higher likelihood of severe injury, and more chronic and shortterm pain, suggesting a preventable gap in training efficacy and workplace controls.

Structural & Cultural Barriers

Structural obstacles, such as administrative complexity, inconsistent accommodation processes, and certification challenges, limit both access and progression within trades.

Cultural dynamics, especially stigma, "old boys' club" norms, and misconceptions about visible and nonvisible disabilities, shape whether workers disclose, request support, or remain in skilled trades careers. Although participants bring strengths (e.g., problem solving, hyperfocus), deficit-based assumptions often overshadowed these assets.

Disclosure is strategic: workers weigh safety, trust, and anticipated stigma, highlighting the need for transparent, psychologically safe pathways to share their disability.

Training & Learning Preferences

Hands-on learning was broadly preferred. Apprentices with disabilities consistently recommend accommodations across three themes: learning style, resources, and physical accommodations.

PPE Design

PPE issues cluster around fit, function, comfort, and sensory load. Poorly designed or ill-fitting PPE can compound disability-related needs and create compatibility conflicts with assistive devices.

Employer Readiness & Accommodations

Many companies reported being insufficiently prepared to accommodate several impairment types; readiness was lowest for vision and mobility impairments. Construction firms were less prepared than other sectors to accommodate mobility and hearing impairments.

Company size matters. Larger organizations showed greater preparedness for mobility and learning-related accommodations, suggesting a resource and capacity gradient.

Assistive Technologies & Workplace Solutions

Evidence scans show a disproportionate focus on physical impairments, with limited solutions for vision, hearing, and cognitive, needs, where many employers felt least prepared

Employers' awareness and integration of assistive technologies into disability management remain uneven; alignment between solutions and trade-specific tasks or functional demands is critical for adoption and impact.

Implications and Next Steps

Across all recommendations, a consistent theme emerges: without trade-specific standards, implementation becomes discretionary, inconsistent, and vulnerable to dilution. Employers may struggle to interpret their obligations, workers may experience uneven access to supports, and accountability mechanisms may remain weak. Therefore, trade-specific standardization is not merely desirable; it is essential to achieving the objectives of accessibility legislation and ensuring that standards result in real, measurable change in skilled trades workplaces.

Conclusions

These findings underscore an urgent need to move beyond generalized approaches to accessibility and toward standards that reflect the unique cultures, tasks, and safety realities of skilled trades work. Persistent cultural exclusion, inconsistent employment practices, complex disclosure dynamics, and uneven accommodation access reveal systems that remain misaligned with the lived experiences of workers with disabilities.

By applying these findings to accessibility standards, a critical opportunity emerges to shift cultures and advance trade-specific accessibility standards. The standards should translate high-level principles into actionable, practical guidance. Without such specificity, implementation risks being fragmented and ineffective. With it, Canada can meaningfully expand equitable participation in the skilled trades, strengthen workforce resilience, and build inclusive trades systems capable of meeting the country's future social and economic needs.

Introduction: Understanding the Importance of Inclusive Skilled Trades in Canada

Authors: Amin Yazdani, Katherine Bishop-Williams, Marcus Yung

INTRODUCTION

Skilled trades are fundamental to the functioning and growth of Canada's economy. Workers in trades occupations build infrastructure, maintain essential services, and support industries ranging from construction and manufacturing to transportation and service sectors (Government of Canada, 2024). Despite their economic importance, Canada's skilled trades workforce is shrinking. In 2021, approximately 1.6 million workers held Red Seal certifications across trades occupations, representing a decline of 5.7% since 2016 (Su et al., 2024). At the same time, projections indicate that more than 220,000 additional certified tradespeople will be required between 2024 and 2028 to meet labour market demand (Government of Canada, 2024). These trends signal a growing skills shortage that poses challenges for economic sustainability and national productivity.

Addressing this shortage will require expanding recruitment and retention strategies beyond traditional labour pools. Persons with disabilities represent a significant and often overlooked source of talent. Persons with disabilities refers to individuals with physical, mental, or cognitive impairments that emerges from the interaction between impairment and environmental or resource-related factors (CSA Z1011, 2024; Fontana et al., 2025). In Canada, nearly one quarter of working-age adults identify as persons with disabilities (CSD, 2023). Yet employment rates remain substantially lower for this group than for people without disabilities, with persistent gaps in workforce participation and earnings (Hardy and Vergara, 2025). Evidence suggests that a substantial proportion of persons with disabilities who are not currently employed have the capacity and desire to work, indicating that structural barriers, not lack of interest or ability, drive much of the employment gap (Hardy and Vergara, 2025).

The skilled trades may represent a promising pathway toward equitable employment outcomes for persons with disabilities. Skilled trades careers can provide stable employment, strong earnings potential, and opportunities for advancement (Government of Canada, 2021). Some research suggests that trades pathways may even function as an economic equalizer; analyses of Canadian secondary school graduates indicate that certified trades workers often achieve higher average earnings than individuals who pursue college or university pathways (Pizzaro Milian et al., 2025; Brown et al., 2024).

Despite this potential, persons with disabilities remain underrepresented in skilled trades occupations. National workforce data show that approximately 13.5–13.8% of Red Seal certified workers identify as persons with disabilities, several percentage points lower than representation across the broader Canadian workforce (CAF, 2023; Su et al., 2024). These disparities reflect a complex interaction of structural, social, and organizational barriers that influence employment outcomes. Research across sectors has documented discrimination in hiring practices, limited opportunities for advancement, and insufficient knowledge among employers regarding disability accommodation (Bonaccio et al., 2019; Nittrouer et al., 2024; Vornholt et al., 2017). Individuals with disabilities frequently report encountering stigma, aesthetic bias, and skepticism about their productivity or qualifications (Groschl, 2007; Baker et al., 2018).

In skilled trades environments, these barriers may be further complicated by the nature of work tasks and workplace cultures. Trades workplaces often prioritize physical performance, technical skill, and productivity, which can shape assumptions about workers' abilities and influence access to opportunities (Bailey et al., 2022). Research in related sectors has shown that workers with disabilities may face ceilings in training and advancement, exclusion from career development opportunities, and limited access to accommodations (Soeker et al., 2018; Gupta et al., 2021). However, empirical evidence specifically examining disability inclusion within skilled trades remains limited. Much of the existing literature focuses on other sectors or on general employment experiences rather than the unique environments of skilled trades workplaces (Bailey et al., 2022).

Accessible employment is both an economic and social imperative. Canadian legislative frameworks such as the Accessible Canada Act and the Employment Strategy for Canadians with Disabilities seek to eliminate barriers and promote equal participation in the labour market (ESDC, 2024). These and other frameworks collectively affirm that equitable access to employment is a right rather than a privilege. However, legislative protections alone do not ensure equitable workplace practices. Translating policy commitments into meaningful inclusion requires understanding the barriers, perceptions, and practical constraints experienced by workers and employers within specific sectors.

In the skilled trades, accessibility challenges may involve multiple interacting factors. Safety requirements, productivity expectations, and workplace cultures may shape

perceptions about the feasibility of accommodating workers with disabilities. Even if cultural barriers to workplace integration for persons with disabilities were overcome, accommodation barriers remain. Limited awareness of available workplace accommodations or assistive technologies can create uncertainty for employers who wish to support inclusive employment (Lengnick-Hall et al., 2008; Ripat and Woodgate, 2017). Existing disability management guidelines and best practice frameworks provide general recommendations for inclusive hiring and accommodation practices (CHRC, 2026; CSA Z1011, 2024). However, these frameworks rarely address the task-specific and environment-specific realities of skilled trades work. As a result, employers and workers often lack practical guidance on how to implement inclusive employment strategies within these contexts.

Workplace support solutions and accommodations, including assistive technologies, task modifications, adaptive tools, and flexible work arrangements, offer opportunities to bridge this gap. These solutions can enable workers with disabilities to perform essential job tasks rather than shifting individuals into adjacent or alternative roles. Research across occupational contexts has demonstrated that assistive solutions can improve productivity, job satisfaction, and workforce integration for individuals with diverse impairments (Morash-MacNeil et al., 2018; Nevala et al., 2015; Mitchell et al., 2025). However, access to these solutions remains uneven, and knowledge gaps persist regarding their implementation and effectiveness within skilled trades settings (Padkapayeva et al., 2015; Steel, 2019). Therefore, understanding accessibility in skilled trades employment requires attention to multiple perspectives and systems. Workers with disabilities navigate complex decisions regarding disclosure, accommodation, and career advancement (Kulkarni, 2022; Tomas et al., 2022). Employers must balance operational requirements, safety considerations, and accommodation processes while navigating evolving policy frameworks. Critical knowledge gaps remain regarding employer readiness to provide accommodations, the availability of assistive solutions tailored to trades tasks, and the lived experiences of workers with disabilities pursuing skilled trades careers.

This report addresses these gaps by examining accessibility in skilled trades from multiple complementary perspectives: workers, employers, and previous scientific studies. The projects presented in this report explore employer readiness to accommodate workers

with disabilities, the availability of assistive technologies and workplace support solutions, and the lived experiences of persons with disabilities navigating skilled trades employment pathways. Collectively, these studies contribute new evidence on how structural barriers, workplace cultures, and technological solutions intersect to shape employment outcomes. The goal of this report is to document challenges and to illuminate opportunities. Expanding accessibility within skilled trades has the potential to strengthen workforce participation, support economic sustainability, and advance equity in Canada's labour market. Achieving these outcomes will require coordinated efforts across employers, educators, policymakers, and workers themselves.

The chapters that follow present five interconnected projects examining accessibility in skilled trades employment and providing an evidence base for understanding current barriers, identifying potential solutions, and informing future research, policy, and practice aimed at building a more inclusive skilled trades workforce:

- Disability and Inclusion in the Skilled Trades: A Phenomenological Study of Employment Barriers and Supports
- Unlocking Untapped Talent: Inclusive Training Practices for Persons with Disabilities in Skilled Trades
- Underutilized Talent: Assessing Employer Preparedness to Include Persons with Disabilities in the Canadian Skilled Trades.
- Assistive Technologies for Persons with Disabilities in Skilled Trades: A Scoping Review
- Workplace Support Solutions for Persons with Disabilities in Skilled Trades: A Systematic Environmental Scan.

Disability and Inclusion in the Skilled Trades: A Phenomenological Study of Employment Barriers and Supports

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ABSTRACT

Persons with disabilities remain underrepresented in skilled trades across Canada despite ongoing labour shortages. Little is known about their experiences navigating trade entry, workplace culture, personal protective equipment (PPE), accommodation processes, and disability disclosure. This study examined how disability interacts with employment structures, environments, and expectations across trades.

Using an exploratory phenomenological approach, semi structured interviews were conducted with 31 skilled trades workers, students, and apprentices who self identified as having one or more disabilities. Reflexive thematic analysis was supported by co interpretation with advisory and lived experience groups. The Functional–Expressive–Aesthetic (FEA) framework guided analysis of PPE related findings.

Participants demonstrated adaptability and persistence but faced multilayered barriers across the employment trajectory. Structural obstacles, including administrative complexity, inconsistent accommodation processes, and certification challenges, restricted access and progression. Cultural norms, including stigma, “old boys club” dynamics, and misconceptions surrounding visible and invisible disabilities, further limited equitable participation. Disability related strengths (e.g., hyperfocus, problem solving) were acknowledged but often overshadowed by deficit based assumptions.

PPE experiences centred on fit, function, comfort, and sensory load, with disability specific needs intensifying consequences of poor design. Participants described compatibility challenges with assistive devices and identified simple, scalable improvements to enhance usability and safety. Learning preferences reflected the importance of hands on instruction, clear steps, repetition, aids, and mentorship. Accommodation access was uneven, and disclosure decisions were shaped by safety considerations, trust, and anticipated stigma.

Strengthening equity in skilled trades requires streamlined administrative processes, inclusive PPE design and procurement, disability confident supervision and mentorship, and transparent, trust based accommodation and disclosure pathways. Sector specific implementation of existing national disability frameworks is essential to advancing safe, inclusive, and sustainable skilled trades careers.

KEYWORDS

Workplace accommodation, barriers to employment, employment resources, disability disclosure

INTRODUCTION

Disability and Skilled Trades Employment

Physical, cognitive, mental, and other impairments shape the employment cycle for persons with disabilities, from application and hiring to retention and advancement (Bonaccio et al., 2019). Despite growing disability and employment research, the experiences of persons with disabilities seeking employment in skilled trades are less understood. Data demonstrates, persons with disabilities remain underrepresented in skilled trades (Canadian Apprenticeship Forum (CAF), 2023). Understanding how disability intersects with skilled trades employment is an equity and economic imperative.

Disability is increasingly defined through a biopsychosocial lens (CSA Z1011, 2024; Fontana et al., 2025). Lederer et al. (2014) identified numerous definitions of work disability, though most emphasized relationships between health conditions and environmental demands shaping functional limitations. Functional limitation is therefore dynamic; it changes with job demands, accommodation practices, and structural conditions. In skilled trades, these dynamics may have heightened impacts due to physical and productivity expectations.

Canada has established multiple legislative and strategic frameworks to reduce employment barriers, including the Accessible Canada Act (2019). Provincial approaches continue to vary (Kovacs Burns and Gordon, 2009). The Canadian Human Rights Act prohibits employment discrimination (Legislative Branch, 2024) The Employment Strategy for Canadians with Disabilities outlines a national goal of closing the employment gap by 2040 (ESDC, 2024). Research evaluating anti-discriminatory legislation suggests that such policies reduce stigma (Nittrouer et al., 2024), but workplace practice gaps persist.

Data from the 2022 Canadian Survey on Disability show that 24.1% of working-age adults identify as persons with disabilities (CSD, 2023). Prevalence was higher among women and gender-diverse individuals and increased significantly since 2017. Unemployment among persons with disabilities arose from 5.4% to 7.8%. In 2024, employment among adults without disabilities was 66.2%, compared to 46.4% for persons with disabilities (Hardy and Vergara, 2025). Youth experienced the sharpest declines. Wage gaps widened from

$1.91 to $2.22 per hour. Many persons not in the labour force reported wanting to work, indicating structural, not motivational, barriers (Hardy & Vergara, 2025). Individuals with less severe disabilities were more than twice as likely to be employed as those with very severe disabilities (Hebert et al., 2024). Persons with disabilities were more likely to work part-time (Hebert et al., 2025), though part time work is uncommon in trades.

Employment Barriers for Persons with Disabilities

Globally, persons with disabilities commonly identify disability as their primary employment barrier (Yeager et al., 2006). In Canada, employer discrimination and labeling remain major obstacles (Shier et al., 2007). South African studies report training ceilings limiting advancement (Soeker et al., 2018). A scoping review found most interventions targeted pre employment rather than workplace advancement barriers (Jetha et al., 2019). Persons with disabilities remain concentrated in entry level roles (Kaye, 2009) and frequently experience underemployment (Shahidi et al., 2023). Disability specific factors, such as severity and age at onset, also shape employment (Gupta et al., 2021).

Employer perceptions significantly influence hiring. Concerns about accommodation costs and doubts about qualifications influence hiring decisions (Baker et al., 2018). Despite diversity, equity, and inclusion initiatives, persons with disabilities continue to experience fewer opportunities and reduced career growth (Bonaccio et al., 2019). Discrimination is a persistent theme in disability and work research (Vornholt et al., 2017). Bias persists despite lacking empirical basis (Lengnick-Hall et al., 2008) and training-based bias reduction shows limited long-term effectiveness (Calluso and Devetag, 2024). Canadian studies highlight employer education, individualized systems, and accessible supports as key enablers (Christianson-Barker et al., 2025).

Between 2016 and 2021, trades employment declined by 97,940 workers, with youth facing the largest reduction (Su et al., 2024). Ontario employers report stigma, mental health concerns, and recruitment challenges (Howe et al., 2023). Red Seal data show only 13.5% of trades workers identify as persons with disabilities, far below workforce proportions (CAF, 2023). Red Seal data show only 13.5% of trades workers identify as persons with disabilities, far below workforce proportions (CAF, 2023). Meanwhile, over 222,000 journeypersons are needed between 2024–2028 (ESDC, 2025). This gap highlights an opportunity for inclusive recruitment.

Across industries, employers are rarely proactive in recruiting persons with disabilities (Lengnick-Hall et al., 2008). Barriers begin during apprenticeship entry (Mitchell et al., 2023). Red Seal data show only 13.5% of trades workers identify as person with disabilities, far below workforce proportions (CAF, 2023). Meanwhile, over 222,000 journeypersons are needed between 2024–2028 (ESDC, 2025). This gap highlights an opportunity for inclusive recruitment.

Despite barriers, trades may offer equitable earnings. A study of 100,000 Toronto secondary students found certified trades workers had the highest earnings (Brown et al., 2024), and students with disabilities entered trades more often than other pathways. Wage disparities were larger outside trades. Students with disabilities may also be encouraged towards trades (Parekh, 2013). Yet trades occupations themselves face social devaluation, creating dual stigma (Pizzara Milian et al., 2025). Still, trades apprentices in Australia reported strong employment and improved quality of life (Cocks et al., 2015). Research on lived experience in trades remains limited (Bailey et al., 2022). Gaps include hiring, discrimination, and policy-practice disconnects. Phenomenological approaches are needed to better capture these experiences (Bailey et al., 2022). Calls for equity in construction date back decades (Dainty and Baglihole, 2005; Powell and Sang, 2013).

Personal Protective Equipment (PPE) Barriers for Persons with Disabilities

Experiences in trades are also shaped by PPE access and usability. Federal legislation requires protective PPE but does not mandate appropriate fit (Legislative Services Branch, 2026). Some provinces, such as Ontario and BC, now require PPE to fit a diverse range of workers (Ontario, 2024; WorkSafe BC, 2022). Poor fit and discomfort are top reasons for non-use (Sehsah et al., 2020; McPherson, 2008). Limited research assesses PPE fit for diverse trades workers (Tennant et al., forthcoming), and none address disability-specific fit issues. Pandemic-era literature focused on disability–caregiver PPE interactions, not workers' own PPE experiences, leaving a gap.

Accommodation and Disclosure of Disability at Work

Advancing employment equity requires addressing environmental barriers contributing to work disability (Fontana et al., 2025). Assistive technologies and accommodations support productivity across disability types (Morash-Macneil et al., 2018; Mitchell et al., 2025). Yet implementation is inconsistent; workers report stigma and inadequate training (Ripat & Woodgate, 2017). Many accommodation requests are denied (Gupta et al., 2021), and dissatisfaction is common (McDonnall et al., 2023). Disparities align with social determinants such as race and education (Kaye et al., 2010). Organizational cultures may view accommodations as unfair advantages (Lovett, 2021), while employers cite cost concerns and lack of awareness (Sepulveda, 2021; Steel, 2019). Evidence supports integrated, individualized disability management systems (Tompa et al., 2015; Wahidin et al., 2018).

Disclosure decisions involve self perception, workplace culture, timing, and privacy (Tomas et al., 2022). Workers balance professionalism, authenticity, and advocacy (Kulkarni, 2022) Disclosure can help contextualize accommodation needs (Patton, 2022). In trades, disabilities often remain undisclosed (Raykov & Taylor, 2013). Bias-reduction tools can reduce stigma but effects fade over time (Ruggs & McGonagle, 2023).

Study Objectives

This study aimed to characterize the experiences of persons with disabilities in skilled trades. Given the breadth and depth of perspectives shared by participants, the results and discussion are organized into three thematic sections. Accordingly, the study pursued three overarching objectives:

Objective 1: To examine the employment experiences of persons with disabilities in skilled trades, including barriers and facilitators encountered across the employment trajectory, from career entry, application and hiring, to workplace culture, retention, and advancement.

Objective 2: To investigate how disability interacts with workplace environments and equipment in skilled trades, with particular attention to PPE fit, function, sensory and

cognitive impacts, and workers' recommendations for improving PPE accessibility through the lens of the Functional Expressive Aesthetic (FEA) model.

Objective 3: To analyze accommodation and disclosure processes among skilled trades workers with disabilities, including learning preferences, accommodation strategies, organizational supports and barriers, and the factors influencing decisions to disclose disability and the implications of disclosure for accessing workplace accommodations.

METHODS

Study Design and Approach

This study employed an exploratory qualitative design using a phenomenological approach (Bevan, 2014), supported by thematic analysis. A phenomenological lens was selected to deeply examine the lived experiences of persons with disabilities in skilled trades, emphasizing contextual factors, subjective meaning-making, and structural conditions shaping those experiences. Thematic analysis supplemented this approach due to the relative internal homogeneity observed across participant narratives (Ahmed et al., 2025).

The project was collaboratively designed, and data interpretation occurred with two groups. A project advisory committee of six institutional and agency representatives—each engaged professionally in skilled trades or disability services—provided methodological and contextual guidance. A lived experience advisory group of six individuals meeting study eligibility criteria contributed to data interpretation and ensured experiential validity. Both groups met online throughout the project. Members of the lived experience group received compensation equivalent to interview participants ($75 per session), while advisory committee members participated as part of their professional roles. The study received ethics approval from the Conestoga College Research Ethics Board (REB #603).

Participant Recruitment and Engagement

Participants were eligible if they self identified as living with one or more disabilities and were working in, or pursuing, a skilled trade in Canada. Disability was defined for participants as “a difficulty in functioning (e.g., physical, mental, etc.) that may affect day to day life,” and self report was accepted without requiring diagnostic documentation. Skilled trades were defined using Skilled Trades Ontario (STO) classifications across construction, motive power, industrial, and service sectors (STO, 2023).

Participants were recruited via institutional partnerships, poster campaigns, a skilled trades college, trades employers across Canada, and disability services agencies. Recruitment used purposive and snowball sampling. Participants completed a one hour interview and were compensated with a $75 gift card. Interviews were conducted in person, by phone, or via video conference based on participant preference and location.

Participants received an information letter and consent form and were provided interview questions in advance to facilitate preparation, accessibility, and meaningful engagement (Haukas & Tishakov, 2024).

Participant Interviews

A semi structured interview guide with open ended questions was developed a priori and reviewed with advisory groups before data collection. The guide included five primary questions and associated probes. Interviews began by inviting participants to describe their trade, role, and experience, followed by an exploration of disability experiences and their relevance to work.

Subsequent questions addressed employment experiences such as applying for positions, navigating workplace culture, career advancement, disclosure decisions, and recommendations to improve trades accessibility. Consistent with phenomenological interviewing, questions included descriptive and structural components and incorporated imaginative variation to explore potential scenarios (Bevan, 2014). For instance, participants were asked how differences in inclusive hiring practices or pay would influence their choice between two employers.

Data Validation and Processing

All interviews were audio recorded and transcribed verbatim using advanced speech recognition software (MAXQDA, VERBI Software; Berlin, Germany). Audio recordings were reviewed to verify transcription accuracy and deepen researcher familiarity with participant narratives.

Transcripts were labeled with participant demographics, including age group (<30, 30–45, >45), gender identity, skilled trade, province or territory, and identified disabilities.

Synthesis, Thematic Analyses, and Validation

Participant characteristics were summarized using descriptive statistics to contextualize interview data.

Qualitative data were analyzed using the thematic analysis framework by Braun and Clarke (2006), aligned with constructivist epistemology. Thematic analysis supplemented phenomenological inquiry due to strong patterns of internal coherence within participant

accounts (Ahmed et al., 2025). Following thorough data familiarization, initial codes were generated inductively through open, line by line coding. A comprehensive codebook reflecting participant language and emergent ideas was developed and applied across all transcripts.

Preliminary themes were drafted, reviewed, and refined through iterative cycles. First, the research team examined thematic coherence. Next, both advisory groups participated in co interpretation sessions, providing experiential and contextual validation. Final themes were named and illustrated using direct quotations. Fillers and repeated words were removed from quotes to promote clarity and uphold dignity in representation (Rockmann & Vough, 2023).

Credibility and trustworthiness were enhanced through triangulation with literature and advisory group insights, member checking, maintenance of an audit trail, researcher reflexivity, and peer debriefing, consistent with postpositivist and critical qualitative research paradigms (Creswell & Miller, 2000). Validation checks strengthened the reflexive thematic analysis process (Ahmed et al., 2025).

FEA Framework Analyses of PPE

Comments related to PPE were examined using both inductive codes and the FEA Framework (Lamb & Kallal, 1992). The FEA model has been applied in garment design, PPE development (Wagner et al., 2013; Oo & Lim, 2023), and analyses of PPE accessibility for underrepresented populations (Tennant et al., forthcoming).

Inductive codes for PPE experience included distraction and stimulation, forgetting to wear PPE, comfort and fit, functionality, and “no issues.” These were then reviewed using FEA aligned deductive codes:

- Functional: fit, mobility, comfort, protection, donning/doffing
- Expressive: values, roles, status, self esteem
- Aesthetic: design principles, art elements, body garment relationship

Accommodation Analysis

As with PPE, accommodation data were initially coded inductively. Following open coding, additional deductive codes were applied to assess alignment with themes identified by Bishop Williams et al. (under review), including learning preferences, available resources, and physical settings. These themes, developed from survey data from 298 apprentices with disabilities, provided an analytic structure for evaluating accommodation experiences across classroom and workplace settings.

RESULTS

Participant Demographics

Thirty-one in-depth interviews were conducted; participant characteristics are described in Table 1. Most participants were male (58.1%, n=18), less than 30 years old (51.6%, n=16), from Ontario (n=23, 74.2%), and came from either electrical (33.3%, n=11) or mechanic and millwright trades (24.2%, n=8). Participants represented a range of training and career levels: high school vocational students (n=4, 12.9%), pre-apprenticeship (n=7, 22.6%), apprenticeship (n=5, 16.1%), completed apprenticeship but not certified (n=10, 32.3%), and journeypersons (n=4, 12.9%). Participants described experiencing varied impairments that impacted their day-to-day life as a disability, ranging from common diagnoses such as attention deficit hyperactivity disorder (ADHD, n=18, 58.1%) and anxiety (n=10, 32.3%) to vision, mental health, processing, and speech impairments. Summaries of impairment categories represented among the participant population are reported in Table 2.

Table 1. Demographics of interview participants about lived experiences as persons with disabilities in skilled trades.

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	18	58.1
	Female	11	35.5
	Non-binary or Transgender	2	6.5
	Missing	0	0
Age Group	Under 30 years	16	51.6
	30-45 years	6	19.4
	Over 45 years	3	9.7
	Missing	6	19.4

Characteristic	Category	Frequency (n)	Percentage (%)
Province (not mutually exclusive)	British Colombia	3	9.7
	Alberta	2	6.5
	Saskatchewan	0	0
	Manitoba	1	3.2
	Ontario	23	74.2
	Quebec	1	3.2
	New Brunswick	0	0
	Nova Scotia	0	0
	Prince Edward Island	0	0
	Newfoundland and Labrador	0	0
	Territories	1	3.2
	Missing	3	9.7
Trade (not mutually exclusive)	Electrical	11	33.3
	Mechanic and Millwright	8	24.2
	Carpenter	2	6.5
	Culinary and Pastry	2	6.5
	Plumbing	2	6.5
	Tool and Die	2	6.5
	Renovations	1	3.2
	Greenhouse Technician	1	3.2
	Hairstyling	1	3.2
	“Mixed” Construction	1	3.2
	Roofer	1	3.2
	To be determined	1	3.2
	Missing	0	0
Career Level	High School	4	12.9
	Pre-Apprenticeship	7	22.6
	Apprenticeship	5	16.1
	Completed Apprenticeship, Not Certified	10	32.3
	Journeyperson	4	12.9
	Missing	1	3.2

Table 2. Diagnostic categories of interview participants represented.

Diagnostic Category+	Frequency (n=31)*	Percentage (%)
Pain-related, flexibility, mobility, dexterity	15	48.4
Mental health-related	11	35.5
Seeing	4	12.9
Learning	23	74.2
Hearing	3	9.7
Memory	1	3.2
Developmental^	1	3.2
Unknown	N/A	N/A
Pain-related, flexibility, mobility, dexterity	15	48.4

+According to Statistics Canada Categories (2023)
*Categories are not mutually exclusive
^Includes communication impairments (e.g., stuttering) if not learning-related impairments

Objective 1: To examine the employment experiences of persons with disabilities in skilled trades.

Lived Experiences in Skilled Trades: Adaptability and Perseverance

Participants consistently described perseverance and adaptability as foundational to navigating both disability and skilled trades work. These qualities were described not merely as coping mechanisms, but as long standing life skills shaped through lived experience. One participant stated, “I get to experience it. It’s my ability… I don’t view them as disabilities. […] I am able to persevere and push through and I do” (Participant 23).

Adaptability was similarly characterized as an ingrained life skill that supported participants across diverse situations. For instance, one participant explained, “I adapt really quickly to new environments” (Participant 24). Others emphasized that disability-related experiences shaped their work ethic, empathy, and collaboration efforts, thereby strengthening resilience in the trades: “[My disabilities] basically have shaped my work ethic,

my empathy, and my adaptability… it made me more resilient in the face of pressure" (Participant 8).

Several participants described needing to work "even better" or "more diligently" than others to counter assumptions about reduced capability: "Things take longer for me… I'm more diligent about my work, I've been told" (Participant 28). These reflections illustrate how perseverance and adaptability function both as personal strengths and as responses to cultural expectations within trades workplaces.

Barriers Faced by Persons with Disabilities in Trades Culture

1. Paperwork and logistical barriers across the career trajectory

Participants described recurring bureaucratic and logistical challenges beginning at apprenticeship entry. These included misfiled apprenticeship documents, unclear registration processes, and contradictory guidance from institutions or unions. As one participant shared, "I didn't get into school until 2020 because my apprenticeship wasn't set up correctly and I had no idea" (Participant 3). Another noted, "[Company] said, 'apply to the union,' and the union said, 'talk to the company'" (Participant 17).

During training, logistical barriers often emerged around accessing accommodations. For example, one participant described misalignment between test scheduling and accommodation deadlines: "They require a week notice… I only get like a week notice at best" (Participant 16).

Participants who trained during COVID 19 disruptions or the labour strike at their training provider organization reported inconsistent supports: "There were some supports for some parts… there was next to nothing for shop work" (Participant 1), and "My email never got responded to… I've been going about it without accommodation" (Participant 18).

Post training, certification processes introduced additional obstacles. Several participants noted confusing or changing procedures for booking exams and requesting accommodations: "They've made it way more difficult… I booked my exam not knowing I had to ask for accommodations first" (Participant 11).

2. Physical demands and job fit

Some barriers stemmed from physical demands of specific trades or tasks. One participant described withdrawing from ironwork, “I applied to the ironworkers and that was a lot heavier, lifting rebar and taxing on the body, and I didn’t even get to finish the job orientation because it was just it was too taxing on my body. I wasn’t physically able to handle it,” (Participant 27). Others described shifting trades to find roles compatible with chronic pain or functional limitations, such as moving from carpentry to plumbing. One explained,

“I did start in carpentry at first and the main thing is, I want to do [Renovation]. But I couldn’t really do renos because of my back. So, that’s when I went into plumbing. I thought plumbing would be a lot easier until I realized it wasn’t. I was only plumbing for like two months until I realized.”

(Participant 29)

3. Transportation barriers

Reliance on driving was a common challenge. One participant shared, “It’s been hard because right now I can’t drive” (Participant 31). In many trades, lack of a driver’s license reduced employability, mobility, or ability to accept job placements.

Impacts of Disabilities on Skilled Trades Worker

Participants described disability impacts that aligned closely with characteristics of their impairments, such as communication differences among participants with autism spectrum disorder or attention related challenges among those with attention deficit hyperactivity disorder (ADHD). For example, a participant noted, “It definitely affects my ability to socialize… people think I’m weird” (Participant 21), while another stated, “My cat walks by and I’m distracted… my brain is telling me I can’t do it” (Participant 26). Some participants also highlighted the advantages of neurodivergent traits, such as periods of hyperfocus.

Across disability types, participants described impacts on work speed and processing time. One participant noted, “I’m not afforded the tools or the time in a test setting” (Participant 26). Others framed slower pace as consistent with accuracy and reduced waste:

“It was more of: “If the spindle is not running, I’m not making money.
Why aren’t you running this through?” The place I worked at before my current job, I

> took my time and my boss kind of knew what was going on at this point. He didn't care because I wasn't scrapping anything."
>
> (Participant 3)

Meanwhile, others explained how their ADHD made them want to work faster: "I like to get things done quick and go, go, go and just get the job-at-hand done," (Participant 32). A participant outlined how the delay in initiating tasks coupled with their ability to work faster likely made them work at a typical speed anyway: "I feel like I'm pretty middle of the road since it takes me a longer time to start new tasks. But once I've started them, I'm really fast," (Participant 2).

Confidence and clarity of instruction also emerged as relevant. Some participants described misalignment between their learning needs and supervisory communication: "Unless the people I'm working with understand how I learn, they don't necessarily get it" (Participant 3). Another shared how initial training undermined confidence when instructions were unclear:

> "The one job I started, I was comfortable in the interview and everything. And then when I went to the floor and they were explaining things that were new to me, my anxiety hit a high. [...] You want to produce a good job; you want to keep that employment is your main concern. They look at it as a lack of confidence."
>
> (Participant 10)

Misconceptions and Stereotypes in Trades Culture

Participants commonly reported facing misconceptions related to laziness, incompetence, or lack of commitment. One participant explained, "I try to stay ahead so I don't need accommodations... people think I can't do the job" (Participant 31). Another noted, "People assume ADHD is lazy or irresponsible... it's actually a difference in how I focus" (Participant 8).

Some felt their inconsistent performance due to disability was judged more harshly than consistent slow performance by nondisabled peers, "It's more of a shame thing if you can't keep up with what you're regularly doing. If you can't be consistent. If you're

consistently slow, everyone's okay with you coming to work and being slow. They'll think poorly of you, but they'll never expect anything more," (Participant 17). Others described being demeaned when seeking clarification, "I would ask an employer or a foreman to

re-explain something, and I would get yelled at because I was an idiot, essentially. That isn't the case at all," (Participant 11). Further, a participant shared how demoralizing these misconceptions can be: "I think employers would just say, 'hey, they have this disability, great, there's a weak link in the chain.' They don't see it as we're still hard-working people. We'll still get the job done. Hell, we'll get it done better than some of the other guys," (Participant 5).

Many associated these misconceptions with "old boys club" culture: "Anybody that wasn't part of the 'good old boys'... was pushed out" (Participant 26). Others described this culture as rooted in generational replication of harsh training norms. The culture sometimes led participants to question their future in the trade: "There were a lot of days where I'm like, should I even keep doing this?" (Participant 6).

Interestingly, some participants believed that neurodiversity was widespread among trades workers—often undiagnosed. Several estimated that a majority of their colleagues likely had ADHD or learning disabilities, though impairment severity varied (Participant 18).

> "Most of us that work in trades are disabled. I will tell you that out of everybody on my floor right now, I'd say 70% of us have ADHD, some type of spectrum."
>
> (Participant 32)

> "I feel like ADHD is actually extremely common. I don't know, for every trade, but especially for electrical."
>
> (Participant 16)

> "Most people that go into trades probably have learning disabilities or ADD or ADHD, or there's something going on."
>
> (Participant 3)

> "I found that a lot of people in the trades are in the trades because they are hands-on learners and they have some sort of learning disability."
>
> (Participant 11)

> "Well, [I think] we all have a bit of ADHD, which, yes, but we don't all have a lot of ADHD. And when you do have a lot... [trailed off]"
>
> (Participant 18).

Applying, hiring, retention, and promotion

Participants described substantial variation in experiences across the employment trajectory, influenced by trade type, employer practices, and their disability-related needs. Some had relatively smooth pathways; others described repeated barriers, inequitable treatment, or challenges navigating hiring systems

Table 3. Participant experiences throughout the stages of employment, disaggregated by positive and neutral or negative experiences.

Employment Stage Experiences	Positive or Neutral Experiences Negative Experiences	Positive or Neutral Experiences Negative Experiences	Positive or Neutral Experiences Negative Experiences	Positive or Neutral Experiences Negative Experiences
Employment Stage	Participant ID, Disability Categories*	Quotation	Participant ID, Disability Categories*	Quotation
Seeking employment and applying	Participant 19 Mental health-related, dexterity	*"It's finding out that there's a good workplace that socially I can be accepted in my ability to apply to [College] because I just before I saw that, I thought it was hopeless."*	Participant 29 Pain-related	*"If you tell an employer before they give you a job, they could limit you [...] or they might not give you the job."*
Seeking employment and applying	Participant 24 Seeing, mental health-related	*"If they want to hire me, that's great, but if not, [...] I get all my applications out there to see which place will actually hire me."*	Participant 31 Memory, Pain-related	*"I guess so. I'm not really sure because I, you know, I haven't been hired, but I guess they look for someone who can drive."*
Seeking employment and applying	Participant 16	*"It took a lot of talking to people*	Participant 20	*"Sometimes when it's the weight limits where you carry 50 to 70*

	Learning	*through [Organization], other resources to get my resume to where hiring managers would like to see for apprentices, but once I did that, it was still challenging finding a workplace. Once I got that, one specific resume, places just hired me. I got two interviews in the same week."*	Mental health, learning, dexterity	*pounds: I'm like, 'okay, I can do maybe 50 to 60, but then once it gets to like 70,' I'm limiting myself. They have that there for a reason, so I shouldn't apply to that."*
Interviewing and Hiring	Participant 21 Learning	*"I think that [my disability will] be helpful because [it] makes me more personable. I know that that's a big thing in getting jobs and getting careers and getting*	Participant 31 Memory, Pain-related	*"I am very honest [and] upfront with companies, and I do see that they appreciate it. But the issue is you never know if they say no because you have all these problems or if they're like, no, because we just don't want to work with you. [...] I've been advised not to speak of it until in-person with them, because you don't want to scare them away."*

		recommendations."		
Retention, Accommodation, and Ongoing Support	Participant 23 Seeing, Mental health-related	*"I advocated for my needs and I told them, 'hey, this is what I need you to do. And if you are unable to do it, I'm either going to have to look somewhere else for my job, or you're going to have to become more accessible towards me.' They were so willing to be accessible because I do a lot there and I provide a lot."*	Participant 5 Learning, pain-related, dexterity	*"Some of my jobs were with drunk employers, where if I gave them the wrong tool, they would throw a hammer at me. Or if I was two minutes late, they would make me walk to the job site. There were employers that were saying, 'Oh, your kids must be so embarrassed to have you as a dad. You're pathetic.'"*
Retention, Accommodation, and Ongoing Support	Participant 17 Pain-related, mental health-related	*"You have to be the best person on site if you have a disability."*	Participant 5 Learning, pain-related, dexterity	*"They wanted me to go back to full work. They wanted me to lie to [Insurance]. They were saying I'm too expensive and I'm not worth it. But I kept fighting it."*
Retention, Accommodation, and Ongoing Support	Participant 21 Learning	*"I think the most helpful thing for anybody to learn*	Participant 31	*"If they can't hire me because it is a safety thing, indicating that's why they're not hiring you. I know*

		about a disability is to ask the person, who actually has the disability. Because the thing I hate the most is when there are these organizations and stuff to advocate. But if they don't have anybody who's on their team who actually has that disability, how do you actually know what it's like ?"	Memory, pain-related Participant 23 Seeing, learning, mental health-related	*technically that would be considered discrimination, but if it's for safety reasons, I feel like that person should know, especially because maybe they can set up a plan."* Participant 23 *"Because why should I tell you what I need when you're my employer. You should ask what I need. [...] That's the part that annoys me the most, is they think that when you have a visual impairment, you can't do the jobs. But they don't bother asking me that."*
Advancement	Participant 5 Learning, pain-related, dexterity	*"I want to see it more like Europe, where they work for five hours, six hours a day. They go home to their families. They go home to their friends and they enjoy life. Here*	Participant 7 Learning, mental health-related, developmental	*"Sometimes you don't have many options, right? I guess, depending on the person and stuff. And in my case, I was pretty determined to find something to do."*

		you make the big boss money or else you're not working. That's why I want to start up my own business. […] I'm going to treat them like they're family."		

** According to Statistics Canada Disability Types (2023); Categories listed in order listed by the participant*

Differential treatment of visible and invisible, mental and physical disabilities

Several participants perceived that disability visibility shaped how colleagues and employers responded to them. Invisible disabilities were often minimized, questioned, or pathologized. As one participant explained, “I feel like since my disability isn't super visible, people are just like, ‘oh, that's weird.’ There must be something wrong with her,” (Participant 31). Another observed that invisibility could mute the perceived salience of disability during hiring: “I don't really think that my disability is one enough to really [impact] the hiring process, because it's not one you can tell when you look at me,” (Participant 32).

Participants also contrasted social responses to mental versus physical disabilities, noting greater stigma and moral judgment attached to mental health conditions relative to physical impairments. One participant articulated this comparison vividly:

> “I wish bipolar was treated like diabetes. Nobody's scared of people with diabetes, and nobody thinks poorly of them. [...] They're like, ‘Oh, they can't help it. Their bodies just don't produce insulin properly.’ I want bipolar to be treated like that too. My mind doesn't distribute the chemical properly.”
>
> (Participant 19)

Together, these accounts suggest that (a) visibility functions as a gatekeeper to empathy, legitimacy, and accommodation, and (b) diagnostic category (i.e., mental vs. physical) shapes perceived credibility and risk in the workplace. These dynamics help explain participants’ reported tendencies to “over perform,” delay or forgo accommodations, or selectively disclose in contexts perceived as safer.

Objective 2: To investigate how disability interacts with workplace environments and equipment in skilled trades.

Experiences of Persons with Disabilities with PPE in Skilled Trades

Participants described a continuum of experiences with PPE, from no apparent issues to significant disability related challenges. About half initially reported no PPE issues; however, several of these participants subsequently provided examples of discomfort or usability problems, suggesting that PPE related discomfort may be normalized in trades contexts. As one participant put it: “[PPE] wasn’t necessarily an issue. I mean, the masks suck, but everybody... kind of agreed with that, right?” (Participant 1).

Forgetfulness, Routine, and Social Safeguards

Participants frequently described forgetting to don, doff, or keep track of PPE, particularly when attention and memory demands were high on busy worksites. “I knew that I had my glasses somewhere, but I forgot it” (Participant 20); “With ADHD it’s very easy to lose tools and forget things at job sites” (Participant 16). Forgetfulness also applied to removal: “I'll be wearing my earplugs in the break room, shouting to have a conversation, and that's until somebody points out, I'm like, ‘oh [explicit] yeah, that makes sense now,’” (Participant 6).

Participants also identified self led strategies (e.g., keeping gear in one place; wearing steel toe boots routinely) and peer prompts as effective compensatory supports: “As long as I keep it all in one place, I'll remember it for the most part. [...] I basically wear steel-toed boots everywhere I go. But, in terms of the harnesses and stuff like that, I try to keep them all in one place,” (Participant 2). These accounts highlight workgroup norms as informal safety nets for executive function challenges.

This subtheme surfaces lived cognitive experience (i.e., attention, memory) and situational scaffolds (i.e., routines, peers), consistent with a phenomenological focus on meaning-making within real work contexts.

Sensory Load, Distraction, and Overstimulation

Participants reported sensory sensitivity and constant awareness of PPE, especially ear protection, safety glasses, gloves, and fabrics. “I have issues trying to forget that I’m

wearing it... I very rarely forget that I have it" (Participant 6). Others described overstimulation: "Ear protection... can get overstimulated... I can get overheated really quickly... breathable fabrics, that's all" (Participant 8). The same participant emphasized materials and textures: "Sometimes I get sensory sensitivity either from materials or textures in the gloves... The right fit, the right fabric, goes a long way" (Participant 8).

Importantly, sensory distraction sometimes resulted from PPE–assistive technology interactions: "When I'm wearing my hat, my glasses get pushed down. Then I constantly have to keep pushing my glasses up. And it's quite irritating because then every time I touch my glasses, I have to go wash my hands. [...] But I need my glasses to see," (Participant 23). These experiences reflect compound design constraints that standard PPE rarely anticipates and clarify how neurodivergent and sensory needs transform otherwise routine PPE into a persistent cognitive load, affecting attention, comfort, and workflow.

Comfort, Fit, and Thermoregulation

Participants linked comfort and fit to sustained wearability and safety and general discomfort: "The type of helmet that [arborists] have clips under the chin. Ours is the tightening on the back. I do find after like a long day of wearing it, it can get kind of painful or whatever on the head," (Participant 2). Another participant said: "If clothes don't fit me right and they just aren't made of good fabrics and materials, it's extremely difficult to do anything," (Participant 18). Another note that relates to disability-specific needs was raised by another participant: "Welding helmets are inflammation to your neck like crazy," (Participant 17). Other participants claimed that their disability impacted their thermoregulation, outlining, "If it's too warm, I find that my hands overheat a lot, so it has to be breathable gloves as well," (Participant 18). Discomfort amplified distraction and time costs: "The longer you wear [PPE] while you're sweating... it moves around... You're doing five seconds of work, then five minutes of wiping everything down... It's really challenging" (Participant 27). Choice and adjustability emerged as cross cutting facilitators: "Sometimes having earplugs... is very discomforting... Just having options would be nice" (Participant 18). Participants explained comfort/fit here is not a mere preference; it is functional and safety critical for sustained performance and hazard mitigation.

Functional Protection Gaps and Safety

Fewer participants reported overt functional inadequacies, but these were consequential when present, especially for sensory impairments. For example, a participant with low vision emphasized needing enhanced protection to compensate for depth perception risks: “I also have a hard time with finding proper shoes... I prefer steel toed... I can easily drop a knife and it will take a toe and I won’t notice” (Participant 23). The same participant described inclusive protection through task specific PPE adjuncts: “When I’m using the mandolin, I have a cut proof glove... and a finger guard... you can hear it if it gets too close” (Participant 23). These accounts underscore that equitable protection may require augmented or specialized PPE, not simply standard-issue, so that safety equivalence is achieved.

Mapping Findings to the FEA Framework

Using the Functional–Expressive–Aesthetic (FEA) model, participants’ accounts of PPE needs mapped most strongly to functional requirements, with selective insights into expressive and aesthetic considerations.

Functional: fit, mobility, comfort, protection, donning/doffing

Most reported challenges were functional. Participants emphasized comfort and fit as prerequisites for sustained wear, safety, and task focus. Sensory load (e.g., itchiness, heat, pressure, glare) operated as a comfort/usability problem that created distraction or overstimulation—particularly salient for neurodivergent workers and for those using assistive devices alongside PPE. Protection needs were sometimes augmented due to disability related risk profiles. As one participant with low vision explained: “So now when I'm using the mandolin, I have a cut proof glove to use. And I also have a finger guard. [...] When I have the finger guard, you can hear it if it gets too close,” (Participant 23). This same participant also needed foot protection that combined non slip soles with steel toes to compensate for depth perception challenges, illustrating how equitable safety may require additional or specialized protective features.

In this dataset, functional shortcomings were the primary barriers to PPE adoption and safe, continuous use: fit/comfort (including sensory tolerance), thermoregulation, protection sufficient for disability specific hazards, and practical donning/doffing and gear management.

Expressive: values, roles, status, self esteem

Expressive themes were less frequent but meaningful where present. Some participants articulated safety values shaped by experience (e.g., hearing conservation) and perceived organizational commitment (or lack thereof) via cost and access to appropriate PPE:

> "All I can say: start earlier. I mean, when I was younger, I probably never wore hearing protection when I probably should have. [...] The rules have all changed over the years, gotten better. I suspect that the hearing loss issue, as time goes on, will become less."
>
> (Participant 30)

> "That also could be on a financial level because I generally look for thrift store finds... That's hard to find well fitted clothes when you need them immediately."
>
> (Participant 18)

> "It's a little harder to get some of the safety equipment through some employers because, 'oh, it costs too much money'... or, 'we can get it for you,' but they don't get it for you."
>
> (Participant 5)

> "If I wasn't in the union, I would not be able to afford my prescription safety glasses."
>
> (Participant 17)

Expressive dimensions appeared primarily through safety identity, norm shifts, and signals of inclusion/exclusion conveyed by whether employers fund and facilitate access to appropriate, including specialized, PPE.

Aesthetic: design, body–garment relationship, identity expression

Disability specific aesthetic considerations were rare, but two salient threads emerged:

1. Quality and appearance in everyday wear (e.g., durability, materials that maintain color/finish under heat and friction):

> "Everything has to be higher quality… thermal active… If you have cute stuff and it gets all messed up… it's good to have higher quality stuff… heat, friction… wiped the [colour] off."
>
> (Participant 27)

2. Identity and religious expression intersecting with protective design (e.g., facial hair and respiratory protection):

> "Because I have a beard, it doesn't create a full seal… maybe… improve PPE that could go over your head because sometimes due to religion, some people can't shave their beard whatsoever."
>
> (Participant 29)

Aesthetic concerns intersected with function where body–garment relationships (e.g., facial hair) directly affect seal integrity and thus protection. In these cases, "aesthetic" design choices enable both identity expression and adequate protection.

Suggestions to Improve PPE for Persons with Disabilities

Participants proposed targeted, practical improvements, predominantly enhancing functional performance while carrying expressive (inclusion, access) and occasional aesthetic (i.e., materials/finishes, identity compatible) implications.

> Mitigate vibration and joint load (Functional): "All those vibrations go up to your body… your hand… knee joint problems. Maybe… better foam pads or knee pads." (Participant 29).
>
> Reduce sensory irritation via glove construction (Functional/Aesthetic): "If gloves were made more inside out style so that the seams were on the outside… Or if the seams were flat… that was really nice." (Participant 18).
>
> Improve eyewear adjustability and retention (Functional): "Maybe a silicone padding… along the ear bits… designs that have an adjustable ratio to where it lands on your

nose versus ear… Some way to keep it from falling off my face would be nice." (Participant 18).

Support thermoregulation (Functional): broader access to breathable fabrics for garments and gloves (Participants 8, 18).

Ensure compatibility with assistive devices (Functional): headwear/eyewear that co exists with prescription or specialized lenses without slippage (Participant 23).

Respect religious expression while preserving protection (Functional/Aesthetic): beard compatible respiratory solutions to maintain seal while honoring religious practice (Participant 29).

Address cost and access (Expressive/Functional): employer or union provision of specialized/prescription PPE to eliminate financial barriers and signal organizational commitment (Participants 5, 17, 18).

Many of these suggestions are low complexity changes (e.g., padding, adjustability) with high impact on comfort, sensory load, and sustained use. Others (e.g., beard compatible respiratory protection, vibration mitigation) may require procurement policies and alternative device options to ensure equivalent protection.

Objective 3: To analyze accommodation and disclosure processes among skilled trades workers with disabilities.

Learning preferences among persons with disabilities in skilled trades

Participants described diverse learning preferences that mapped closely to patterns identified in prior work (Bishop Williams et al., under review). Five recurrent preferences emerged across impairment types: practical (hands on) instruction, clear and concrete instruction, repetition, aids and information, and supported learning through mentors/teams. In addition, physical learning conditions clustered into visual, auditory, and movement accommodations, with participants emphasizing individualized adjustments (e.g., brighter vs. dimmer lighting; quiet spaces vs. white noise) rather than a single "best" setting.

Practical (hands on) instruction: Many participants identified hands on learning as both a preferred mode and a primary reason for choosing the trades: "I found that a lot of people in the trades are in the trades because they are hands-on learners and they do have

some sort of learning disability" (Participant 11). Participants wanted demonstrations, opportunities to handle materials, and immediate application: "Once I've done it once, it's firmly in my brain. For me I'm very hands-on and need to have it in front of me doing it as I'm being told" (Participant 32).

Clear, concrete instruction: Participants stressed the need for stepwise, explicit directions without metaphors or abstract shorthand. One participant described difficulty with "follow the power" as an instruction for electrical flow: "I understand following the power, but I need... the full circuit... where does the rest of it go? That's where I get lost" (Participant 20).

Repetition: Repeated practice-built confidence, accuracy, and speed: "Doing things over and over again, like repetition... when you're going from suite to suite to suite" (Participant 7). Participants linked repetition directly to independence on core tasks.

Aids and information. Written instructions, checklists, calendars, and plans supported memory, reduced cognitive load, and enabled self checking: "Written instructions are always very helpful... This will get burned into my mind... those first couple times, it's very helpful to have things on paper" (Participant 21). Participants valued workplaces that normalized making such resources available: "I'm able to print off whatever I'm doing... a step by step" (Participant 10).

Supported learning (mentors/teams): Participants frequently referenced the importance of supportive coworkers and mentors, both in formal instruction and on the job: "A lot of coworkers will help me with reading and the big terminologies" (Participant 4); "There's a lot of guys [who] help each other out quite a bit" (Participant 7). For some, mentorship transformed psychological safety and participation: "He'd be like, 'I see where you're coming from... here's where you tweak your thinking'... It made me feel comfortable about speaking" (Participant 5).

Accommodation in Skilled Trades

Consistent with prior survey findings (Bishop Williams et al., under review), accommodations described by participants fell into two broad categories: (1) resource related accommodations based on learning preference, and (2) physical accommodations.

1. Resource-related accommodations:

Flexibility in tasks and timing: Participants emphasized value in flexibility, both in how tasks are completed and in pacing (i.e., extra time, breaks, splitting tasks, occasional absences). Flexibility reduced anxiety and improved quality: “It just allows your brain not to worry about time... I’ve never ended up using the full period” (Participant 15). Some noted limits to available flexibility (e.g., minimum durations for test accommodations): “I can’t use the accommodation for anything less than an hour... My quizzes might only be 20 minutes” (Participant 21). Participants also highlighted a desire for part time options and non punitive absences for disability related needs, contrasting this with strict “show up and work” expectations: “If you are unwell and the expectation is you show up every day or the government can remove you from your apprenticeship or the school can remove you; that's a big punishment. [...] The option should not be you either show up every day, or you drop out,” (Participant 17).

Access to resources: Participants described four commonly needed resources:

1. Aids and information: lack of aids was experienced as systematically undermining success: “They stripped me of the memory aid. And when I wrote my first test, I actually failed,” (Participant 3) and, “Why don't we just help people get the license? Put out information to study so people can pass, so the industry doesn't just go belly up,” (Participant 15).
2. Tutors: particularly important for certification exams: “[Agency] gave me a tutor. I'm ecstatic. I've waited two years for a tutor, so I've had some tutoring, and that's been great,” (Participant 10); “I did 60 hours of tutoring with an amazing tutor,” (Participant 26).

3. Learning strategists: to help coordinate accommodations, health and safety, navigate apprenticeship systems, and identify learning needs; many wished they had access earlier.

4. Technology: for lifting or manual material handlings and for reading/vision support (examples detailed in Table 3).

Table 3. Participant quotations about the technology accommodations they used in skilled trades by impairment type.

Impairment/ Disability Type	Participant ID	Quotation
Learning	P28	*"I don't know what the program is, but just on an Apple phone, I can take a picture of text and it will scan it and then I can listen to it. That's what I usually do if it's stuff like that, or I can if it's usually numbers and stuff."*
Physical	P17	*"In terms of if you physically can't be here because of a medical illness, you should be able to come in online. I think through COVID we've learned the ability to do that."*
	P29	*"The main part I could say is accommodation that could have helped is like, I'm sure it's expensive, but in the long term, it feels like an investment. It always helps. We could install more pulley systems or hoists that instead of us human beings lifting heavy material, constantly moving and hurting ourselves."*
Mental Health	P8	*"The structured routines really help, staying on top of how I organize checklists, how I organize the tools, virtual reminders, sticky notes or alarms."*
Seeing	P25	*"So, I'll just use my phone because it's quicker. I can just speak it in right away. Okay, this is the item the person's looking for. Press on it, open it, find the product number, put it into my scanner right away, zoom in, find where it's located and go ahead and grab it for the customer instead of me."*
Hearing	P30	*"From [insurance] to get hearing aids. I got the letter this week or last week, and then I'll have to go to a hearing aid place and get them made up."*
Memory	P31	*"If my teacher's doing a PowerPoint, they can share it with me. Stuff like that. Just because I might not remember it. I make my own notes, but they might not be the greatest."*
Developmental	--	No example provided.

Some participants reported not knowing what accommodations would be useful, believing none existed for certain impairments, or not needing accommodations once schooling or certification were completed. Others adopted self strategies (e.g., listening to music for focus) as alternatives to formal accommodations.

2. Physical accommodations:

In line with earlier categorization, participants discussed visual (lighting), auditory (noise level/white noise), and movement (opportunities to stand, stretch, or change position) supports. Importantly, participants emphasized directional adjustments, for example, either brighter or dimmer light depending on individual needs, underscoring the importance of individualization rather than one size fits all settings. (See Table 4 for quotations.)

Table 4. Example quotations that demonstrate the variability of preferences and participant needs related to each of the categories of physical accommodations and the diagnostic categories or impairments they face.

Physical Accommodation Type	Participant ID and Diagnostic Category(ies)*	Quotation seeking more physical input	Participant ID and Diagnostic Category(ies)*	Quotation seeking less physical input
Visual	P23 Vision, mental health-related, learning	*"Or if it is paper, I will ask them to give me black paper with white writing. So, the color contrast. I much prefer. It's so much easier when I'm in a darker setting versus a lighter setting because I am sun blind."*	P8 Learning, mental health-related	*"Sometimes I get sensory sensitivity [...] The lighting, sometimes the lighting affects me, too."*
Auditory	P32 Learning	*"It might even be nice for headphones in class. Not even with music, but just white noise. Because anything distracts me extremely easy in the class. I always try and sit in the very front row. So, there's no one in front of me that can distract me."*	P18 Learning	*"I just get extremely distracted in all manners of things, especially with the noise, it has been so loud and there's so many different noises going on, it's pretty overwhelming. I have to constantly have earplugs in, and even then, it's still a bit much and takes away from my focus."*
Movement	P29	*"I mean, the more difficult parts are either sitting or kneeling down.*	P22	*"So, when those tables are kind of your station, you get an engine,*

	Pain-related	*But in terms for me to get rid of the pain, the main part I do is just stand up and walk around."*	Vision	*you take it apart, you put parts on those tables or under the table, and that's usually where you work. But for safety, they won't just let a blind person just walk in there. They'll guide them to their location where they need to be."*

** According to Statistics Canada Disability Types (2023); Categories listed in order listed by the participant.*

Successes and Challenges in Accommodation

The most prominent facilitator for successful accommodation was related to supported learning, including individualized planning and mentors or instructors who cared for the worker's circumstances, and programs or institutions that provided funding and resources: "Studying and the group... having those people there (Participant 14). "The programs... the institutions... helped a lot. Having the funding to give those resources to the people in the programs, that actually helped me out so much that it actually made me able to live better," (Participant 27).

Participants identified four major barrier types:

1. Misconceptions and stereotypes. Assumptions that needs were exaggerated or "common and manageable" without support; preference for sink or swim instruction: "Old school journeyman... 'I'm telling you what to do. You get it? We move on, we learn something else" (Participant 27).

2. Insufficient preparation among instructors/employers. Low patience for questions, limited awareness of learning differences in the trades: "Little to no patience for questions" (Participant 1); "A lot of carpenters and like carpenter businesses don't acknowledge that that is, actually, a pretty high part of the trade, that there are actually quite a few of us who struggle" (Participant 11).

3. Macro-level disruptions. COVID 19 restrictions and the Ontario college support staff strike impeded access to spaces and staffing, respectively: "Extra people... to assist you weren't actually allowed to be there" (Participant 1).

4. Outright denial of accommodations. Participants reported denials in workplaces, especially small employers, and in certification/testing centers, sometimes due to changing processes or paperwork hurdles: "If you ask for an accommodation... you kind of get laughed at" (Participant 6); "I'm a picker. I work in perishable and freezer, and grocery gets really hot in the summer. That's part of the reason why I fainted, actually, because I didn't use my accommodation because the boss at the time that was there didn't let me. And I was like, 'Okay, well, I'm not doing so hot." (Participant 31).

Disclosure of Functional Limitations and Disabilities in Skilled Trades

Participants often carried mixed perspectives about whether, where, and to whom they would disclose. Participants described reluctance due to stigma, fear of judgment, or prior negative experiences:

> "I'm still learning how to navigate. I'm still trying to learn how to communicate. For me personally, I have a really hard time in general asking for help. And then I also have a really hard time disclosing information about myself that might be kind of embarrassing and also could give a judgment about a person."
>
> (Participant 11)

Another participant explained their rationale as: "It's the stigma. I'd be way more likely to disclose to a boss about anxiety than I would be about bipolar. Bipolar and borderline. There is such heavy stigma with both of those," (Participant 19). Some participants noted that visually impaired workers feared systematic denial: "We live in fear… We're just going to get denied" (Participant 23).

Two core rationales shaped disclosure decisions:

- Safety. Disclosing to protect oneself and others on site: "Safety related. Just, I'm with the people every day" (Participant 28).
- Transparency. A perceived responsibility to inform, despite risk: "It is the right thing to do to disclose… but that typically leads to a loss of jobs" (Participant 23).

Where to disclose varied. many would disclose in school but not work, citing greater perceived protection and understanding in educational settings: "Going into a job, I would never ask for an accommodation. Going to a school, I would… They're more understanding" (Participant 10); "For school, I'm paying to be here… With workplaces… They'll find another reason [to fire you]… In the end, it's because of that [disability]" (Participant 21).

Who to disclose to hinged on trust, mutual respect, and familiarity: "Depends on the employer" (Participant 7); "Some people… you just feel more comfortable [with]" (Participant 20); "Trust in leadership… whether my employer would do something helpful rather than just follow paperwork" (Participant 8). Negative past experiences often reduced willingness to disclose in the future.

Resources for Employers to Accommodate Skilled Trades Workers with Disabilities

Participants recommended actions across employers, government, colleges or secondary schools, and training centres, while also noting limited awareness of existing resources.

For employers, Suggestions included: (a) transparent job postings that identify core tasks and examples of possible accommodations (some cautioned this can feel performative if not genuine); (b) culture building for inclusion; (c) positioning trades as a strong fit for many persons with disabilities (e.g., hands on learning). Many participants believed employers should lead with inclusive employment but were uncertain about specific implementation steps.

For the government, proposed roles included grants and funding for both employees and employers, incentives for journeyperson mentorship, employment support centres, and restoring/expanding funding at key milestones (e.g., completion of training levels and certification exams). Participants referenced programs they had seen discontinued.

For colleges and secondary schools, participants urged earlier, non judgmental promotion of trades careers and visible examples of successful workers with disabilities to support self efficacy: “That would probably be high school… they already do target people… with ADHD” (Participant 2). Some felt secondary schools were underperforming in this area.

For training centres (i.e., union and non profit), suggested roles included connecting candidates to employers, sponsorship throughout apprenticeship, funding distribution, certification support, and helping individuals visualize full career pathways in the trades.

Across interviews, participants emphasized that learning preferences and accommodations are highly individualized, yet common patterns, hands on instruction, clarity, repetition, aids, and supportive mentorship, can be systematically supported. Successful accommodation was most likely where flexibility, resources, and supportive relationships converged, while misconceptions, insufficient preparation, system level disruptions, and denials constrained equity. Disclosure remained a risk reward calculus shaped by stigma, trust, and context, with participants more willing to disclose in educational than employment settings.

DISCUSSION

Overview

Across three objectives, this study shows that persons with disabilities in the skilled trades navigate a landscape marked by structural hurdles, cultural barriers, and uneven access to accommodations and inclusive equipment, alongside considerable resilience and strengths that support success. The findings reinforce evidence of persistent inequality in employment opportunities (e.g., wage and unemployment gaps (Hardy & Vergara, 2025)) and identify sector specific levers, particularly within apprenticeships, certification processes, workplace culture, and PPE design and procurement, that can close those gaps.

Objective 1: To examine the employment experiences of persons with disabilities in skilled trades

Structural and Cultural Barriers

Participants described administrative friction, paperwork errors, unclear processes, and complex rules that constrained entry, training progression, and certification. These barriers were often most acute at apprenticeship onset and during certification (e.g., Red Seal exam accommodations) and were amplified by system disruptions such as COVID 19 and the labour strike at training providers, which interrupted access to space, staffing, and communication supports. These experiences mirror evidence that inclusive apprenticeship pathways remain underdeveloped (De Raaf et al., 2024) and align with broader data showing widening disability related gaps in employment and wages (Hardy & Vergara, 2025).

Culturally, participants encountered stereotyping, gatekeeping, and “old boys club” norms, consistent with research documenting marginalization and hiring discrimination based on social status characteristics (Vornholt et al., 2017; Calluso & Devetag, 2024; Bailey et al., 2022). These norms often translated into pressure to “over perform” to achieve comparable recognition and advancement, an experience that contributes to cumulative fatigue and attrition. Participants also noted differential responses to visible versus invisible disabilities; invisible conditions were sometimes minimized or misunderstood, while visible disabilities could prompt unwanted scrutiny or judgment.

Functional Impacts and Strengths

Workers reported impacts related to attention, timing, communication, and social interaction, frequently intensified by employer misunderstandings rather than intrinsic limitations (Stokar & Orwat, 2018; Groschl, 2007). At the same time, participants articulated strengths (e.g., hyperfocus, adaptability, persistence) that align with strengths based frameworks and challenge deficit oriented narratives (Wehmeyer & Shrogen, 2016; Ormerod & Newton, 2013). Physical demands were not universally prohibitive, but pain, mobility, dexterity, and flexibility constraints mattered for some; transportation limitations also constrained job access and mobility for certain workers, and assistive technologies may mitigate certain tasks (Du et al., under review; forthcoming), whereas sensory, cognitive, vision, and hearing needs often require systemic, not only individual, solutions.

Entry, Retention, and Advancement

Hiring experiences ranged from supportive to exclusionary. Participants perceived limited proactive recruitment of disabled workers (Lengnick Hall et al., 2008) and described dual stigma: disability plus the social devaluation of trades relative to other sectors (Pizzara Milian et al., 2025). Retention and promotion were discussed less frequently but, when raised, often required sustained extra effort to achieve parity, potentially contributing to "training ceilings" (Soeker et al., 2018) and motivating entrepreneurship as a route to model inclusive practice.

Objective 2: To investigate how disability interacts with workplace environments and equipment in skilled trades

PPE as a Safety and Equity Lever

Although PPE sits at the base of the Hierarchy of Controls (Morris & Cannady, 2019), it remains indispensable, and only effective when fitted properly, used consistently, and used as intended (Onyebeke et al., 2016; Brisbane et al., 2022). High injury rates in trades elevate the risks when PPE does not accommodate disability related anthropometric and functional differences. Poor fit and the performance penalties it creates, such as slower reaction times, reduced mobility, altered muscle activity, have been widely documented (Ammad et al., 2020; Bartkowiak et al., 2021; Brisbane et al., 2022). As seen with women in construction

who lack access to appropriate sizes (Onyebeke et al., 2016), underrepresented groups face layered PPE inequities. Notably, PPE satisfaction correlates with job satisfaction (Wagner et al., 2013), underscoring potential links to retention. Participants also described conflicts between PPE and assistive devices (e.g., prescription/specialized lenses or hearing technology) that increased discomfort and reduced usability, highlighting an additional pathway to inequitable exposure.

Central Experience: Fit, Function, and Comfort (Including Sensory Load)

Participants' experiences cohered around fit, function, and comfort, with sensory load (i.e., seams, breathability, device weight/pressure, glare) producing distraction, fatigue, and symptom exacerbation, beyond generic comfort concerns (McPherson, 2008; Sehsah et al., 2020; Brisbane et al., 2022). They also noted executive function challenges (e.g., attention and memory demands) and routine executive function challenges (such as forgetting to don or doff equipment), for which workers proposed low cost, high yield strategies including spare kits, designated storage routines, continuous wear for certain items, and peer prompts. These data point to organizational and manufacturer levers that can yield swift improvements.

Persistent Knowledge and Policy Gaps

Despite growing interest in universal design (Bharath & Zakariya, 2021), disability specific PPE research in trades remains sparse; recent reviews identified no studies focused on improving fit/comfort for workers with disabilities (Tennant et al., forthcoming; Du et al., under review). An environmental scan catalogued PPE-adjacent adaptation (e.g., colour filter glasses, clear masks, hearing aid compatible hearing protectors, enhanced grip gloves, custom footwear) (Du et al., forthcoming), but these primarily modify tools or tasks rather than PPE fit or comfort itself. Provincial requirements for appropriately fitting PPE are inconsistent (Ontario, 2024; 2026; WorkSafe BC, 2022), and national guidance only briefly addresses disability within body type and gender considerations (CCOHS, 2025). The result is heavy reliance on individual workarounds and variable employer practices. Together, these gaps underscore the need for inclusive PPE design, procurement policies that stock multiple

models/sizes (including beard compatible RPE), and routine fit/comfort trials to ensure sustained, safe use.

Objective 3: To analyze accommodation and disclosure processes among skilled trades workers with disabilities.

Learning Preferences and Effective Supports

Participants consistently identified practical (hands on) instruction, stepwise clarity, repetition, aids (e.g., checklists, written instructions), and mentorship as foundational supports, aligning with prior survey findings among Ontario apprentices and vocational learning literature (Bishop Williams et al., under review; Mackiwicz, 2025; Lei & Panicker, 2025). They also emphasized individualized physical and sensory conditions (lighting, noise/white noise, opportunities to move/stretch), suggesting the need to operationalize universal design and structured instructional practices in shop and site settings. These supports mirror the results themes of clarity, repetition, aids, and mentor supported learning across classroom, shop, and workplace contexts.

Accommodation: What Helps and Where it Breaks

Desired accommodations centered on flexibility in timing and pacing (extended time, pacing, non punitive absences), information supports, tutors/learning strategists, and task/assistive technologies. Evidence supports time extensions for some learners (Wei & Zhang, 2024), though debates about “over accommodation” persist in higher education (Harrison & Armstrong, 2022). In the trades, flexibility is site-based (e.g., schedules, sequencing), not telework; it remains critical to safety, learning, and retention. Access was uneven across context: unmet needs for communication/technical aids (Gupta et al., 2021; 2023), mixed associations between flexibility and lost time (Jessiman Perrault et al., 2025), and lower employment probability when needs go unmet, especially for early and late career workers (Schimmele et al., 2024). Employers reported low readiness and uncertainty about accommodation feasibility (Bishop Williams et al., forthcoming HR), while misconceptions, policy limits, and cost concerns persisted (Groschl, 2007; Sepulveda, 2021; Nittrouer et al., 2024; De Raaf et al., 2024). Consistent with these results, participants often lacked clear pathways to request accommodations and experienced variability between school and work settings.

Disclosure: Risk, Trust, and Context

Disclosure decisions reflected a risk–benefit calculus organized around worksite safety (protecting self and others) and transparency (perceived duty to inform), filtered through stigma, trust, and context (Tomas et al., 2022; Kulkarni, 2021). Participants were typically more willing to disclose in school than at work, citing perceived protection and responsiveness. Experiences diverged: some saw benefits (i.e., providing a rationale for accommodations; Patton, 2022), others reported penalties (i.e., stigma, job loss; Bam, 2025; Pantaleon et al., 2023; Gignac et al., 2025). Participants also noted that visible and invisible disabilities carried different social consequences, complicating decisions to disclose and the timing of that disclosure. Trust in supervisors and institutional culture were recurrent determinants, echoing the Results.

Resource Awareness and Diffusion

Participants were largely unaware of employer oriented resources and national frameworks (DWC, 2019; CSA Z1011, 2024; ESDC, 2024; Canadian Centre for Diversity and Inclusion, 2023; Canadian Human Rights Commission, 2026). This diffusion gap suggests that existing guidance is not reaching trades employers or frontline workers effectively, leaving individuals to self advocate in the absence of supportive organizational systems (Christianson Barker et al., 2025; Tompa et al., 2022). Findings underscore the need to translate national guidance into trade specific toolkits, simple workflows for accommodation requests, and supervisor training.

Cross-Objective Synthesis

Legislative and strategic frameworks exist, but implementation lags within trades ecosystems, especially at apprenticeship entry, testing/certification, and site level practices (e.g., scheduling flexibility, PPE procurement and fit testing, accommodation workflows). Standardized, transparent processes and timelines are pivotal to reduce administrative friction.

Small, manufacturer level PPE changes (e.g., breathable fabrics, flat/external seams, adjustable eyewear, beard compatible respirators, wider size/shape ranges) and procurement policies (e.g., offering multiple models/sizes, on site fit/comfort trials) can

produce outsized gains in safety, use, and retention for workers with disabilities. Inclusive PPE is part of reasonable accommodation and safety equivalence.

Addressing “old boys club” norms and knowledge gaps through supervisor/mentor training, disability confident HR, and structured mentorship can reduce stigma, enhance learning, and normalize accommodations. Embedding mentor roles and checklists/aids into routine practice operationalizes this shift. Confidential, predictable, and trust-based disclosure and accommodation processes, anchored to safety rationales and job relevant needs, can lower stigma costs and improve uptake. Clear points of contact, documented responses, and non-retaliation assurances are essential.

LIMITATIONS

This qualitative study used a broad, self-determined definition of disability, consistent with contemporary conceptualizations, rather than an explicit “work disability” definition. While aligned with strengths based and self-determination frameworks, self-identification may bias participation toward individuals with milder or undiagnosed conditions and limits comparability across the diverse work disability definitions in the literature.

Although participants reflected varied demographics, disability types, and trades, the sample does not capture the full range of skilled trades or impairment severities. With over 50 Red Seal trades nationally, trade specific cultures and job demands may produce unobserved barriers. Individuals with more severe disabilities appeared underrepresented, potentially mirroring broader employment exclusion. The study also lacked sufficient power to analyze differences by trade, impairment type, or disability severity (visible vs. invisible), constraining subgroup inference.

Researcher positionality and co interpretation with advisory groups strengthen interpretive validity but may also shape emphasis and meaning. As with all qualitative research, transferability depends on context; findings reflect shared themes rather than universal experiences.in addition, older workers were underrepresented (~10%), potentially attenuating reports of PPE fit/comfort challenges that increase with age; disability severity was not formally assessed, and anthropometric variation (e.g., hand morphology with

arthritis) was not measured, limiting design relevant precision. The interview guide emphasized function; expressive/aesthetic PPE dimensions (FEA) may be underarticulated relative to functional concerns. Moreover, heterogeneity across institutions and employers limited our ability to disentangle system vs. site level barriers to accommodation and disclosure. Finally, the study took place amidst recent system disruptions (e.g., pandemic; college support staff strike), which may have amplified administrative and access barriers beyond typical conditions.

FUTURE DIRECTIONS

Future work should adopt trade stratified sampling and severity indexed measures (including visible/invisible and episodic conditions) to enable subgroup analyses by trade, impairment type, and disability severity across the employment trajectory. For PPE, studies should collect disability specific anthropometric data (e.g., hand morphology in arthritis; facial hair and seal variables; head/face dimensions for eyewear/respirators), conduct fit and comfort trials in real job tasks, and explicitly probe the expressive and aesthetic dimensions of FEA alongside function. In apprenticeships and certification, implementation research should test simplified accommodation workflows (e.g., standardized forms, timelines, and points of contact), evaluate procurement standards (e.g., multiple models/sizes, beard compatible RPE, assistive tech compatibility), and assess impacts on safety, learning, retention, and advancement using mixed methods. Multi-site studies that follow workers longitudinally, including periods of flare up and relative stability, will clarify how severity and trade specific demands interact over time and which co-designed solutions (i.e., with workers, unions, and employers) scale effectively in the skilled trades.

CONCLUSIONS

This study demonstrates how structural processes, workplace culture, and equipment design and procurement jointly shape the employment experiences of persons with disabilities in the skilled trades. Participants consistently exhibited adaptability and perseverance, yet faced administrative obstacles (e.g., apprenticeship entry, accommodation workflows, certification logistics, transportation), stigmatized norms (e.g., “old boys club,” differential treatment of visible vs. invisible disabilities), and uneven access to supports (e.g., instructional clarity, mentorship, flexibility, and resources). These dynamics required many to “over perform” to achieve comparable recognition and advancement, reinforcing inequities despite clear disability related strengths (e.g., practical problem solving, hyperfocus, collaborative awareness).

Within the work environment, PPE fit, function, and comfort, including sensory load and compatibility with assistive devices, emerged as pivotal to safe participation, performance, and retention. Applying the FEA framework underscored that functional, expressive, and aesthetic elements are interdependent: small design choices (e.g., seam orientation, breathability, geometry/adjustability, beard compatible respirators) can have disproportionate safety and inclusion impacts. Participants offered pragmatic, design-oriented recommendations that align with disability informed co design and point to actionable levers for manufacturers and employers.

Effective participation was facilitated by hands on instruction, clarity, repetition, aids, and mentorship, alongside site-based flexibility (time, pacing, non-punitive absences). Yet the diffusion of existing policies and frameworks into trades practice remains limited, leaving workers to self-advocate and organizations to improvise. Advancing equity will require operationalizing what is already known: streamlined accommodation processes in apprenticeships and certification; procurement standards that ensure inclusive PPE options and fit/comfort trials; disability confident supervisor and mentor training; and trust based, predictable disclosure pathways tied to safety and job relevant needs. These steps are essential to translate national visions of inclusive work into day-to-day practice across the skilled trades.

Unlocking Untapped Talent: Inclusive Training Practices for Persons with Disabilities in Skilled Trades

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ABSTRACT

Accommodating persons with disabilities is an important step towards an inclusive skilled trades sector; lack of effective accommodation can introduce barriers to entry and retention for skilled trades. This research describes the prevalence of disability among apprentices, their perceptions of disability in apprenticeship, occupational health and safety (OHS) training knowledge, and recommendations for accommodations.

Data were collected through questionnaires with apprentices, gathering demographic information and measures such as OHS knowledge or skills. Analysis included descriptive statistics of disabilities and pain and injury profiles and Chi square tests comparing groups. Qualitative data was assessed via thematic analyses.

Of the 1,486 apprentices who completed the survey, 298 apprentices (20.1%) reported at least one disability. Apprentices with a disability reported significantly lower OHS knowledge or skills in 11 of 13 domains.

Apprentices with a disability were 2.01 (1.399, 2.871; $p<0.001$) times more likely to report a severe injury in the last 12 months. Apprentices with a disability were significantly more likely to report chronic and short-term pain.

Apprentices with and without a disability preferred hands-on-learning. Apprentices with a disability recommended accommodations that primarily fit into three themes: learning style, resources, and physical accommodations.

This paper provides an original analysis of the relationships between disability on skilled trades apprentices and their experience of OHS, including knowledge, pain, and injury.

OHS training accommodations should be implemented for apprentices with disabilities when needed, supporting educators and employers to provide inclusive OHS training, and promoting equitable and inclusive workforce entry.

KEYWORDS

Equitable apprenticeships, inclusive classrooms, learners with disabilities, occupational health and safety training

INTRODUCTION

The skilled trades sector in Canada faces a critical and ongoing workforce challenge. Attrition is increasingly evident as experienced workers retire, and others transition to new careers. Between July 2024 and July 2025, employment in Ontario's trades, transportation, and equipment operator sector decreased by 3.1%, representing nearly 35,000 vacated positions (Labour Market Report, 2025). The 2021 Census of the Canadian population demonstrated that the demand for skilled trades increased relative to the skilled trades workforce from 2016 to 2021 (Su et al., 2024). This shortage threatens productivity and economic stability (Skills Council of Canada, 2024).

Addressing this gap requires more than recruitment; it demands inclusive environments that attract and retain diverse talent. If eligible workers do not feel welcomed and included in the training or workplace settings, recruitment of valuable skilled trades workers may fall short (Skills Council of Canada, 2024), especially among workers from equity-deserving groups, such as females, gender-diverse individuals, newcomers to Canada, and persons with disabilities. Promoting equity and inclusion is essential across all sectors but especially in those facing workforce shortages. The Canadian Labour and Skills Survey identified labour and skills shortages as a major risk factor to industry growth in a globally competitive market (Canadian Manufacturers & Exporters, 2022). Among underrepresented groups, persons with disabilities remain particularly marginalized despite comprising 27% of the Canadian population (Statistics Canada, 2023) but only 13.8% of the Red Seal skilled trades workforce (CAF, 2023). This disparity reflects challenges such as inaccessible training environments, limited accommodations, and attitudinal biases. It is essential to prioritize inclusive training practices, accessible work environments, and targeted supports for equity-deserving groups, to stabilize and strengthen the skilled trades workforce. Previous research suggests that while these gaps have been identified for apprenticeship training for persons with disabilities, substantial work remains (Mitchell et al., 2023). These efforts will help unlock a broader talent pool and ensure that all workers can contribute safely and effectively to Canada's and the global economic future.

Despite ongoing efforts to improve workplace inclusion, persons with disabilities in Canada continue to experience significant disparities in employment outcomes. From 2023 to 2024, the employment rate for Canadians with disabilities was 46.4%, compared to 66.2% for those without disabilities (Hardy & Vergara, 2025). This disparity underscores the need for targeted, systematic strategies to improve access to employment in skilled trades, where labour shortages are projected to continue. Data from the Canadian Apprenticeship Forum (CAF, 2023) show that individuals with disabilities made up only 13.8% of the Red Seal skilled trades workforce, while they represented 27.0% of the general Canadian population (Statistics Canada, 2023). Red Seal skilled trades refer to a nationally recognized certification program for approximately 50 skilled trades. Persons with disabilities remain particularly underrepresented and face unique barriers in the skilled trades. This underrepresentation reflects systemic barriers such as inaccessible training environments, limited accommodations, and attitudinal biases. Addressing these challenges requires coordinated efforts across government, industry, and educational institutions to ensure that apprenticeship pathways are inclusive and supportive of diverse learners.

Understanding disability is essential for creating safe, inclusive, and productive work environments. The International Classification of Functioning, Disability, and Health (WHO, 2001; Padkapayeva et al., 2017; Vornholt et al., 2017) defines disability as “impairment, activity limitations, and participation restrictions.” This aligns with the National Standard of Canada (CSA Z1011, 2020), which describes disability as any impairment or functional limitation—permanent, temporary, or episodic—that, in interaction with barriers, hinders full and equal participation. Disability is often assessed through functional limitations, such as task performance (Vornholt et al., 2017), but this can emphasize deficits. Instead, disability should be understood contextually, where participation restrictions arise from environmental factors (Vornholt et al., 2017; CSA Z1011, 2020). Tuomi et al.’s (1991) widely applied definition (Lederer, 2014) focuses on a worker’s ability to meet job demands relative to health and mental capacity, a concept easily extended to students and apprentices (Padkapayeva et al., 2017; Vornholt et al., 2017).

Accommodations, which are modifications enabling meaningful participation, improve safety and inclusion. Examples include adjusted schedules, assistive technology, and role adaptations (Nevala et al., 2015; Padkapayeva et al., 2017; Vornholt et al., 2017). In apprenticeships, accommodations may involve alternate material formats, extended test time, or supportive instruction. Canada's legislative framework supports these rights through the Accessible Canada Act (ACA, 2019), Canadian Human Rights Act (CHRA, 1985), Canadian Charter of Rights and Freedoms (2024), Employment Strategy for Canadians with Disabilities (2024), and CSA Z1011 (2020). The ACA emphasizes removing societal barriers, while the CHRA and Charter prohibit discrimination and mandate accommodation unless undue hardship occurs. The Employment Strategy promotes inclusive hiring and education, and CSA Z1011 outlines organizational systems for early accommodation and return-to-work policies. For learners, the Ontario Education Act (Government of Ontario, 1990) and Accessibility for Ontarians with Disabilities Act (AODA, 2005) ensure accessible education. Apprenticeship programs allow exam accommodations such as extra time and assistive technology (Centre for Innovation in Campus Mental Health, 2025).

Inclusive access to apprenticeship training programs has been shown to support employment pathways for persons with disabilities (Cocks et al., 2015). Apprentices with impairments or disabilities often face additional challenges in completing their programs, particularly during the in-class training, where accommodations are critical (Brown et al., 2024). Recognizing the diverse abilities of persons with disabilities and proactively addressing their needs through accommodation is essential to improving employment outcomes in the skilled trades. Embedding inclusive practices into apprenticeship training and workplace safety programs is essential to closing employment gaps and fostering equity in the skilled trades workforce.

While inclusion in the skilled trades has been discussed, little attention has been paid to how these disparities intersect with occupational health and safety (OHS) training and outcomes. Research investigating the accommodation necessary for OHS training remains limited. OHS training is vital for preventing injuries and ensuring safe participation in skilled

trades, yet little is known about how disability intersects with OHS learning and injury risk. This study addresses this gap by:

i. Estimating the prevalence of disability among skilled trades apprentice partiipants;
ii. Comparing OHS-related outcomes between apprentices with and without disability;
iii. Exploring associations between disability status, pain, and workplace injury; and
iv. Identifying learning preferences and recommended accommodation for OHS training.

By examining these dimensions, this research aims to inform inclusive practices that strengthen workforce sustainability and safety in Canada's skilled trades.

METHODS

Data Collection

This study engaged apprentices enrolled in skilled trades programs in Ontario. A purposive sampling strategy ensured representation across a range of trades, training levels (i.e., Years 1–3), and training formats (e.g., day-release and block-release; i.e., the classroom-to-workplace training schedule of apprenticeship training). Fourteen skilled trades apprenticeship classrooms were selected between September 2022 and June 2024. Surveys were administered in class using paper-based questionnaires to maximize participation and minimize disruption.

The questionnaire included multiple-choice, multi-select, and open-ended items, drawing on validated tools for program characteristics (International Labour Organization (ILO), 2021) and disability identification (CDC, 2025). Topics included demographics, training format, disability status, OHS training knowledge and values, workplace injury history, and pain profiles. Disability categories included learning, cognitive (i.e., memory-related), hearing, mobility, and vision impairments.

Apprentices were asked to reflect on their OHS training experiences, including how their disability may affect the type or amount of work they can perform. Injury-related questions used a 12-month recall period and captured severity (i.e., first aid, modified duties, or lost time). Pain-related questions, adapted from the Nordic Musculoskeletal Questionnaire (Crawford, 2007), assessed frequency and location of pain across body regions, including neck, shoulder, elbow/forearm, hand/wrist/fingers, lower back, and knee/leg. Pain was classified as short-term (≤30 days), long-term (>30 days), or chronic (ongoing). Open-ended questions invited apprentices with disabilities to recommend accommodations. Based on early survey responses, additional questions on workplace accommodations were added during the latter phase of data collection (n=729), allowing for deeper exploration of support needs across multiple training environments.

Data Analysis

Responses were transcribed into a secure spreadsheet (Microsoft Corporation, Redmond, WA, USA) and analyzed using Stata 13 (StataCorp LLC, College Station, TX, USA). Data cleaning removed incomplete or invalid entries.

Descriptive statistics summarized demographic characteristics, disability prevalence, and pain profiles. Group comparison between apprentices with and without disabilities used Chi-square tests; Fisher's Exact Tests were applied when assumptions were not met. Unadjusted odds ratios estimated associations between disability status and injury or pain. Statistical significance was set at $\alpha < 0.05$.

Qualitative data were analyzed using Braun and Clarke's (2006) thematic analysis framework. Thematic analysis began with a detailed review of responses to gain familiarity with the data. An inductive approach guided the coding, with themes emerging directly from the participant narratives. Codes were refined into broader themes capturing accommodation recommendations and accessibility strategies.

All study procedures were approved by the Research Ethics Board at Conestoga College Institute of Technology and Advanced Learning (REB #451).

FINDINGS

A total of 1,486 apprentices from 14 skilled trades programs completed the survey (range: 3-329 apprentices per program; median= 80 apprentices per program). Most participants were enrolled in block-release training (64.7%) and represented all three program levels (Level 1: 47.6%; Level 2: 21.5%; Level 3: 31.0%). The sample was predominantly male (92.2%), with smaller proportions identified as female (4.2%), transgender (0.9%), or non-binary (0.7%). Nearly half were aged 15-24 (45.9%); 13.3% identified as a visible minority and 2.1% identified as Indigenous.

Overall, 20.1% of apprentices reported at least one disability; 36.9% of those reported multiple disabilities (Figure 1). Cognitive and learning impairments were most common (learning: 14%; memory/concentration: 10.9%), followed by hearing (2.6%), mobility (1.1%), and vision (1.1%) (Table I).

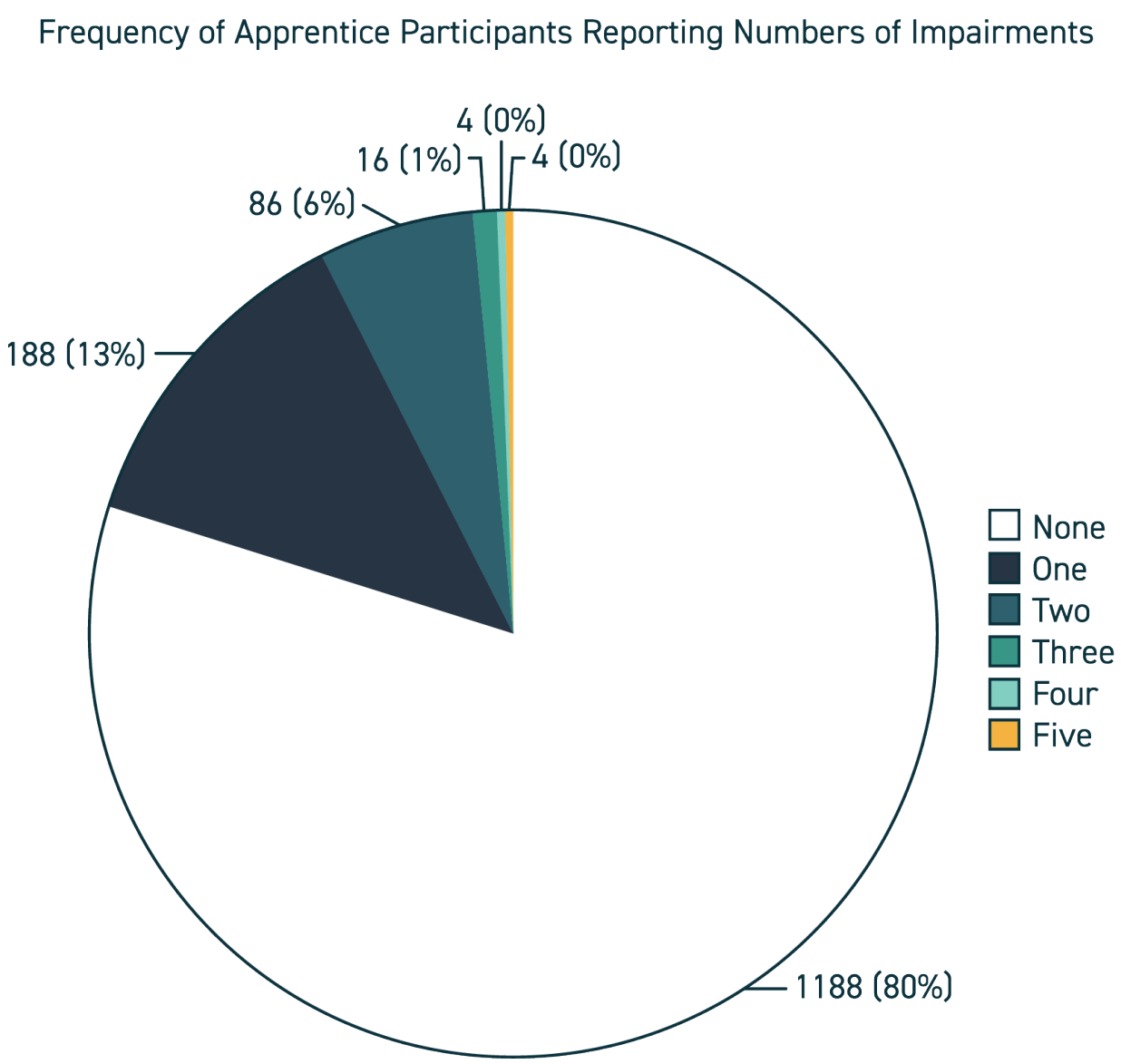

Figure 1. Demographics of survey questionnaire apprentice participants by their count of disability types within the five measured categories: learning impairment, cognitive impairments impacting memory, hearing, mobility, and vision.

Table I. Frequency and proportion of disability types by demographics and apprenticeship traits.

Disability Type Frequency (% of Apprentices in the Program)

	Demographic and Apprenticeship Traits	Any Disability[1]	Diagnosed Learning Disability (n=209 (14. 0%))	Difficulty Concentrating and Remembering or Making Decisions (n=16 3 (10.9%))	Hearing Impairment (n=4 0 (2.6%))	Mobility Impairment (n= 16 (1.1%))	Vision Impairment (n= 16 (1.1%))
Program	Automotive Service Technician (n=24 6)	65(26.4)	42(17.1)	34(13.8)	8(3.3)	2(0.8)	3(1.2)
	Brick And Stone Mason (n=83)	16(19.2)	13(15.7)	6(7.2)	2(2.4)	0	1(1.2)
	Cabinet Maker (n=41)	7(17.1)	6(14.6)	3(7.3)	0	0	0
	Electrician (n=32 9)	60(18.2)	35(10.6)	32(9.7)	11(3.3)	4(1.2)	4(1.2)
	General Carpenter (n=98)	19(19.4)	14(14.3)	8(8.2)	2(2.0)	1(1.0)	0
	General Machinist (n=71)	11(15.4)	8(11.3)	8(11.3)	1(1.4)	1(1.4)	0
	Metal Fabricator (Fitter) (n=75)	20(26.7)	19(25.3)	10(13.3)	0(0)	1(1.3)	1(1.3)

	Millwright (n=74)	11(14.9)	8(10.8)	7(9.5)	2(2.7)	2(2.7)	1(1.4)
	MTBI (n=3)	0	0	0	0	0	0
	Plumber (n=171)	24(14.0)	18(10.5)	14(8.2)	3(1.8)	0	1(0.6)
	Refrigeration And Air Conditioning Systems Mechanic (n=90)	8(8.9)	5(5.6)	7(7.8)	0(0)	0	0
	Tool And Die Maker (n=25)	7(28.0)	5(20.0)	4(16.0)	2(8.0)	0	1(4.0)
	Truck And Coach Technician (n=160)	47(29.4)	33(20.6)	28(17.5)	9(5.6)	5(3.1)	4(2.5)
	Welder (n=20)	3(15.0)	3(15.0)	2(10.0)	0	0	0
Release-Type	Block (n=960)	170(17.7)	119(12.4)	94(9.7)	22(2.3)	6(0.6)	8(0.8)
	Day (n=508)	122(24.0)	86(16.9)	65(12.8)	16(3.1)	9(1.8)	6(1.2)
	Unknown Release Type/ Prefer not to answer (n=18)	6(33.3)	4	4	2	1	2
Apprenticeship Level	1 (n=707)	144(20.4)	105(14.9)	85(12.0)	16(2.3)	6(0.8)	6(0.8)
	2 (n=319)	74(23.2)	48(15.0)	40(12.5)	10(3.1)	7(2.1)	5(1.6)
	3 (n=460)	80(22.2)	56(12.2)	38(8.3)	14(3.0)	3(0.6)	5(1.1)
Age Group	15-24 years (n=682)	132(19.4)	92(13.5)	69(10.1)	19(2.8)	7(1.0)	9(1.3)
	25-34 years (n=508)	108(21.3 %)	78(15.4)	59(11.6)	9(1.8)	3(0.6)	4(0.8)

	35 years or older (n=156)	29(18.5)	21(13.5)	16(10.3)	9(5.8)	3(1.9)	0
	Unknown Age (n=140)	29(20.7)	18	19	3	3	3
Gender Identity	Male (n=1,363)	250(18.3)	173(12.7)	135(9.9)	32(2.3)	11(0.8)	10(0.7)
	Female (n=62)	23(37.1)	17(27.4)	14(22.6)	1(1.6)	0	2(3.2)
	Transgender (n=13)	8(61.5)	7(53.8)	5(38.5)	1(7.7)	1(7.7)	1(7.7)
	Non-binary (n=10)	7(70.0)	5(50.0)	5(50.0)	3(30.0)	1(10.0)	0
	Other gender identities/ Prefer not to Disclose (n=30)	7(23.3)	7(23.3)	4(13.3)	3(10.0)	3(10.0)	3(10.0)
Racial Identity	Indigenous (n=31)	12(38.7)	10(32.3)	7(22.6)	2(6.5)	1(3.2)	1(3.2)
	Unknown Indigenous Identity (n=33)	9(27.3)	6	7	2	2	2
	Visible Minority (n=196)	58(29.6)	41(20.9)	31(15.8)	11(5.6)	4(2.0)	6(3.1)
	Unknown Visible Minority Identity (n=79)	17(21.5)	14	11	5	3	3

*Unknown refers to responses chosen as prefer not to disclose or left blank in the survey questionnaire.

[1] Disability of any type is counted separately as participants with a disability may have identified with more than one disability, therefore, those rows cannot be used as additive measures.

The prevalence of each disability varied across programs (Table I). The prevalence of disabilities varied minimally across the three program levels but was higher among day- than block-release training.

Disability prevalence was higher among non-male, Indigenous, and visible minority apprentices. Male apprentices had a disability prevalence of 18.3%, while prevalence was 37.1% among female, 61.5% among transgender, and 70.0% among non-binary apprentices. Disability prevalence was 38.7% among Indigenous and 29.6% among visible minority apprentices.

Most apprentices with a disability (72.1%) indicated their disability did not affect their ability to work (Table II). Extreme impacts on their ability to work were rarely reported but were most common among apprentices with a mobility (18.8%) or vision impairment (12.5%).

Table II. Frequency of disability types among apprentice participants and their relative impact on training and working.

Disability Type	Self-Rated Impact of Disability on Working in Their Chosen Trade	Self-Rated Impact of Disability on Working in Their Chosen Trade	Self-Rated Impact of Disability on Working in Their Chosen Trade	Self-Rated Impact of Disability on Working in Their Chosen Trade	Self-Rated Impact of Disability on Working in Their Chosen Trade
Disability Scale	None	Slight	Moderate	Extreme	Prefer not to Answer
Any One or More Disability/ies (n=298)	215(72.2)	66(22.2)	8(2.7)	6(2.0)	3(1.0)
Diagnosed Learning Disability (n=209)	157(75.1)	41(19.6)	4(1.9)	5(2.4)	2(1.0)
Difficulty Concentrating and Remembering or Making Decisions (n=163)	104(63.8)	45(27.6)	6(3.7%)	6(3.7)	2(1.2)
Hearing Impairment (n=40)	27(67.5)	8(20.0)	1(2.5)	3(7.5)	1(2.5)
Mobility Impairment (n=16)	6(37.5)	6(37.5)	0	3(18.8)	1(6.3)
Vision Impairment (n=16)	9(56.3)	3(18.8)	1(6.3)	2(12.5)	1(6.3)

OHS Knowledge and Belief in OHS Value

Apprentices with disabilities reported lower OHS knowledge across 11 of 13 domains ($p < 0.001$) (Table III). There were no common characteristics among the domains where significant differences were observed between the apprentices with and without a disability. Both groups were aware of their rights under OHS legislation and uncertain about how to access additional OHS information when needed.

Table III. Apprentice confidence in OHS domains by disability status, compared between apprentices with and without a disability by Chi-Square Tests and reported as unadjusted odds ratios.

Apprentice Confidence in OHS Domains (n) [1]	Apprentices with a disability (% Agree)	Apprentices without a disability (% Agree)	χ^2	Probability ($p < 0.05$) *	Odds Ratio (Confidence Interval)
Ability to work safely (n=1,459)	260(89.3)	1,108(94.9)	12.12	<0.001*	0.454 (0.283,0.741)
Ability to keep coworkers working safely (n=1,460)	264(90.1)	1,376(95.3)	11.61	<0.001*	0.450 (0.276,0.748)
Ability to know which health and safety precautions to take while doing my current or future job (n=1,460)	274(93.8)	1,140(97.6)	10.86	0.001*	0.374 (0.197,0.729)
Ability to identify OHS hazards/ equipment issues (n=1,463)	281(95.3)	1,150(98.5)	11.31	<0.001*	0.314 (0.146,0.692)
Knowledge of OHS rights (n=1,461)	266(90.8)	1,084(92.8)	1.37	0.243	0.763 (0.478,1.251)
Knowledge of labour rights (n=1,454)	236(80.8)	1,045(89.9)	18.47	<0.001*	0.472 (0.329,0.682)
Ability to find additional OHS information (n=1,462)	231(78.3)	960(82.2)	2.44	0.778	0.778 (0.563,1.085)
Knowledge of common workplace injuries (n=1,465)	278(94.2)	1,135(97.0)	5.29	0.022*	0.504 (0.271,0.975)
Knowledge of workplace physical demands (n=1,463)	283(95.9)	1,162(99.4)	24.48	<0.001*	0.122 (0.037,0.355)
Knowledge of emotional/ mental demands of job (n=1,402)	260(91.5)	1,078(96.4)	12.34	<0.001*	0.402 (0.232, 0.711)

That the workplace will provide equipment that is safe and ergonomically designed (n=1,445)	200(69.4)	898(77.6)	8.44	0.004*	0.655 (0.488,0.884)
That training and mentorship will be received through their employer (n=1,443)	227(78.5)	994(86.1)	10.22	0.001*	0.589 (0.421,0.832)
That assigned tasks in the workplace will help to build competency and skills in their trade (n= 1, 452)	261(89.1)	1,110(95.8)	19.89	<0.001*	0.360 (0.221, 0.594)

*Indicates a significant difference

[1] Only completed responses were included in the analysis.

Apprentices with a disability were significantly less likely to agree they believed in four of the five potential values potential value than their peers without a disability (Table IV). The value that OHS improves performance and productivity in the workplace was the only non-significant difference in beliefs between participants with and without a disability; belief in this value was approximately 10% lower than the other beliefs investigated.

Table IV. Apprentice beliefs in the value of OHS by disability status, compared between apprentices with and without a disability by Chi-Square Tests and reported as unadjusted odds ratios.

Apprentice Belief in the Potential Values of OHS Training (n) [1]	Apprentices with a disability (% Agree)	Apprentices without a disability (% Agree)	χ^2	Probability ($p < 0.05$) *	Odds Ratio (Confidence Interval)
Reduce work injuries/ accidents (n=1,463)	277(94.5)	1,146(97.9)	10.24	0.001*	0.262 (0.182,0.741)
Reduce workplace financial loss (n=1,450)	258(89.3)	1,087(93.6)	6.53	0.011*	0.567 (0.359,0.912)
Reduce lost time claims for injuries/ accidents (n=1,462)	269(91.5)	1,117(95.6)	8.16	0.004*	0.491 (0.293,0.844)
Improve performance and productivity for individual and organization (n=1,452)	231(80.2)	942(80.9)	0.08	0.781	0.955 (0.685,1.346)
Improve overall OHS in the workplace (n=1,457)	272(93.8)	1,133(97.1)	7.32	0.007*	0.453 (0.245,0.867)

**Indicates a significant difference*

[1] Only completed responses were included in the analysis.

Workplace Injuries and Pain Profiles

Apprentices with disabilities reported 1.81 (95% CI: 135,2.40; $p < 0.001$) times higher odds of experiencing a workplace injury in the past year compared to those without disabilities (Table V). They also reported 2.01 (95% CI:1.399,2.871, $p < 0.001$) times higher odds of more serious injury in the past year than their peers without a disability.

Table V. Apprentice self-reported workplace injury in the past 12 months compared between apprentices with and without a disability by Chi-Square Tests and reported as unadjusted odds ratios.

	Disability Frequency. (↘)	*No. Disability Frequency. (↘)*	χ^2	p<0.05	OR (CI)
Any injury in the workplace (n=368)	101(35.4)	184(17.3)	17.68	<0.0001*	1.809 (1.353,2.401)
Injury requiring first aid treatment, change of job activities, or lost time from work (n=206)	68(32.7)	138(19.5)	16.16	0.0001*	2.01 (1.399,2.871)

*Indicates a significant difference at alpha of p<0.05

Apprentice participants with a disability reported significantly higher prevalence of short term and chronic pain in nearly all body segments than those without a disability (Table VI). Excluding pain in their hands, there were no significant differences between the reports of long-term pain prevalence between groups.

Table VI. Short-term, long-term, and chronic pain profiles compared between apprentices with and without a disability by Chi-Square Tests and reported as unadjusted odds ratios.

Body Segment	Pain Duration	With Disability Frequency (%)	Without Disability Frequency (%)	χ^2	p<0.05	OR (CI)
Back (n=1,377)		n=282	n=1,095	2.60	0.107	1.303 (0.934, 1.826)
	None	72(25.5)	402(36.7)	2.60	0.107	1.303 (0.934, 1.826)
	Short-Term	116(41.1)	497(45.4)	2.60	0.107	1.303 (0.934, 1.826)
	Long-Term	22(7.8)	72(6.6)	3.83	0.050	1.706 (0.944, 2.993)
	Chronic	72(25.5)	124(11.3)	38.15	<0.001*	3.242 (2.166, 4.842)
Elbow (n=1,326)		n=272	n=1,054	14.92	0.001*	1.751 (1.300, 2.354)
	None	135(49.6)	683(64.8)	14.92	0.001*	1.751 (1.300, 2.354)
	Short-Term	108(39.7)	312(29.6)	14.92	0.001*	1.751 (1.300, 2.354)
	Long-Term	4(1.5)	21(2.0)	0.00	0.947	0.964 (0.237, 2.920)
	Chronic	25(9.2)	38(3.6)	21.14	<0.001*	3.328 (1.857, 5.865)
Hand (n=1,348)		n=269	n=1,079	6.43	0.011*	1.483 (1.081,2.040)
	None	84(3.1)	490(45.4)	6.43	0.011*	1.483 (1.081,2.040)
	Short-Term	121(45.0)	476(44.1)	6.43	0.011*	1.483 (1.081,2.040)
	Long-Term	19(7.1)	46(4.3)	9.20	0.002*	2.409 (1.266,4.432)
	Chronic	45(16.7)	67(6.2)	40.05	<0.001*	3.918 (2.445,6.231)
Leg (n=1,360)		n=275	n=1,085	14.51	<0.001*	1.792 (1.310,2.455)
	None	89(3.2)	528(48.6)	14.51	<0.001*	1.792 (1.310,2.455)
	Short-Term	122(44.4)	404(37.2)	14.51	<0.001*	1.792 (1.310,2.455)
	Long-Term	10(3.6)	48(4.4)	0.34	0.562	1.236 (0.537,2.590)
	Chronic	54(19.6)	105(9.7)	32.10	<0.001*	3.051 (2.003,4.618)
Neck (n=1,348)		n=271	n=1,077	4.05	0.044*	1.349 (0.995,1.827)

	None	119(43.9)	596(55.3)	4.05	0.044*	1.349 (0.995,1.827)
	Short-Term	104(38.4)	386(35.8)	4.05	0.044*	1.349 (0.995,1.827)
	Long-Term	8(3.0)	33(3.1)	0.23	0.633	1.214 (0.472,2.766)
	Chronic	40(14.8)	62(5.8)	29.02	<0.001*	3.231 (2.012,5.138)
Shoulder (n=1,352)	None	n=271	n=1,081	5.47	0.019*	1.422 (1.046,1.934)
	None	107(39.5)	568(52.5)	5.47	0.019*	1.422 (1.046,1.934)
	Short-Term	108(39.9)	403(37.3)	5.47	0.019*	1.422 (1.046,1.934)
	Long-Term	10(3.7)	44(4.1)	0.26	0.608	1.206 (0.525,2.528)
	Chronic	46(17.0)	66(6.1)	39.01	<0.001*	3.700 (2.344,5.797)

OHS Training and Accommodations

Learning preferences were similar among apprentices with a disability and those without (Figure 2). Hands-on-practice was overwhelmingly the most preferred and assigned readings was the least preferred learning strategy among both groups.

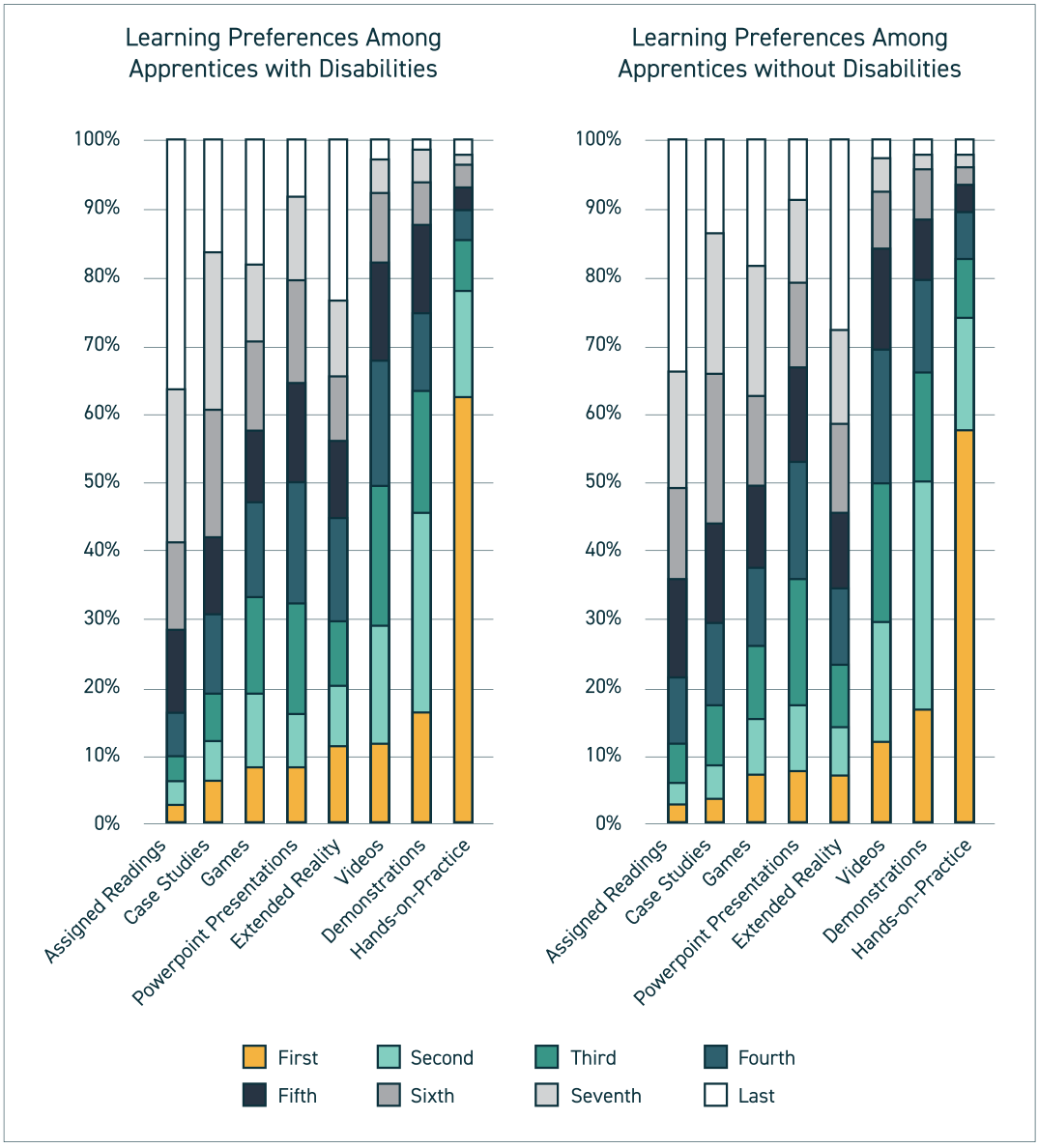

Figure 2. Ranked learning preferences among apprentice participants with and without a disability.

40.6% of apprentices with a disability recommended in-class accommodations to support their learning. Further, 20.6% of the 145 participants with a disability asked about workplace accommodations for disabilities, recommended accommodations. Recommendations for accommodation primarily fit into three main themes: learning style, resources, and physical settings (Figure 3); examples of direct actions to support accommodation were provided.

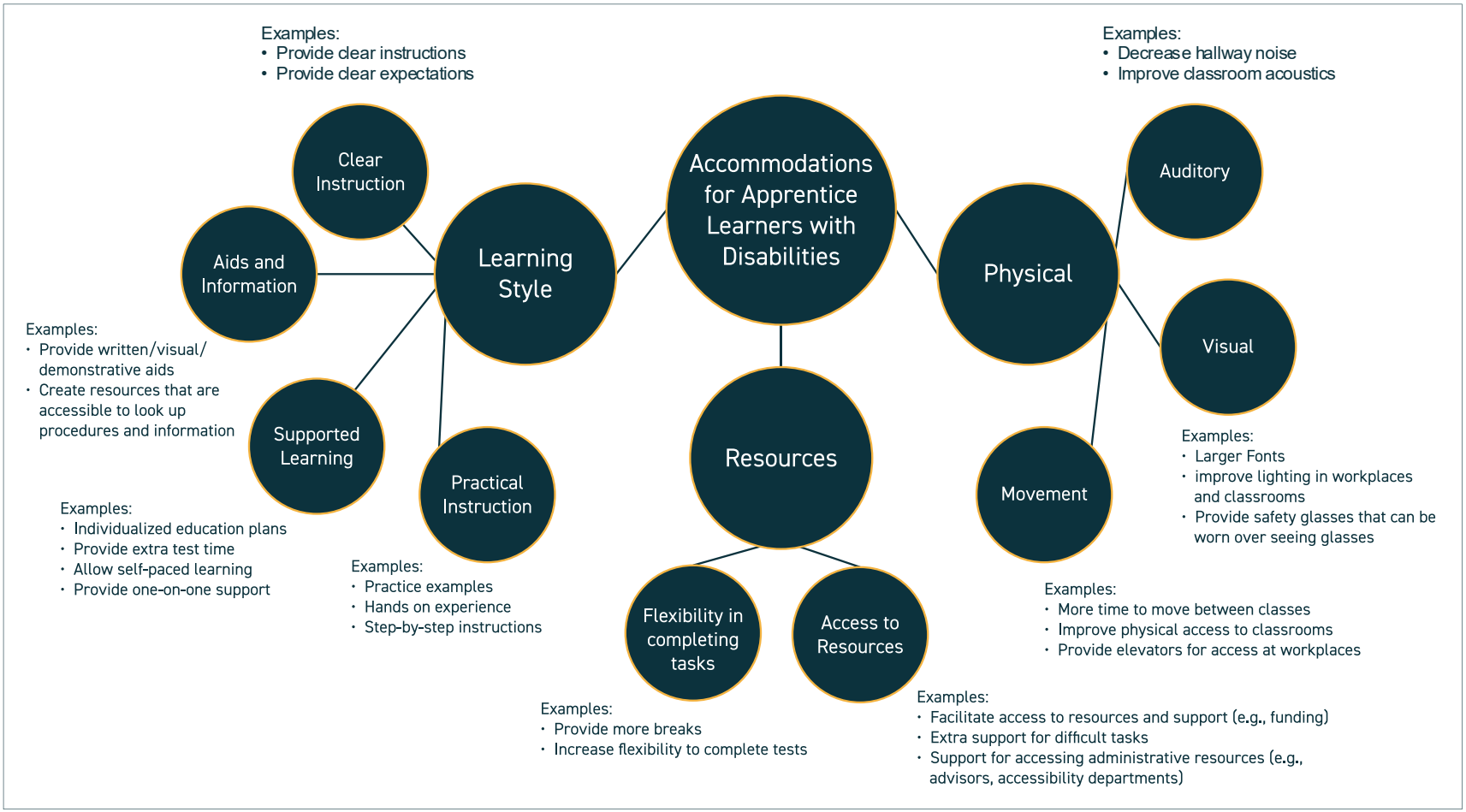

Figure 3. Thematic map of apprentice learning accommodations recommended by survey questionnaire participants with learning disabilities and examples provided by participants.

The first sub-theme for learning style was related to clear instructions for tasks and expectations. Apprentices recommended making aids and information available to apprentices as a reference when completing tasks. Another theme was providing supported learning opportunities in the classroom that met the individual needs of students with disabilities. Finally, apprentices recommended using practical instruction that made the information directly applicable.

Apprentices recommended accommodations that allowed for increased flexibility in completing their tasks, such as order of tasks or timing to complete tasks. Accommodations to support improved access to resources for their learning were recommended.

Several recommendations were directly related to the accommodations needed for physical spaces; these recommendations were more targeted to specific impairments. Reducing white noise for apprentices with auditory impairments, using larger fonts and spaces with better lighting for visual impairments, and classroom designs that meet movement needs for apprentices with mobility impairments were recommended.

DISCUSSION

This study identified significant differences between apprentices with and without disabilities in OHS-related knowledge, perceived training value, workplace injury risk, and pain profiles. The prevalence of disability among apprentices (20.1%) was lower than the national rate of 27% among working-age Canadians (Statistics Canada, 2023), but higher than reported in skilled trades workforce data (CAF, 2023). Learning and memory-related disabilities were most common, contrasting with national patterns where pain and mobility impairments predominate (CSD, 2022). This difference likely reflects the younger age profile of apprentices and potential barriers to entry for individuals with mobility limitations.

Representation in the Skilled Trades

Females accounted for 4.2% of participants, despite representing 14.8% of Red Seal skilled trades workers in Canada (CAF, 2023). Red Seal workforce participation reflects the 50 nationally recognized Red Seal Skilled Trades (CAF, 2023), while Ontario recognizes 144 skilled trades (Skilled Trades Ontario, 2025). Participants represented 14 skilled trades programs, which may not represent some predominantly female skilled trades, such as hairstyling. The gender distribution within the trades is uneven (CAF, 2023); hairstyling, baking, and cooks contribute more female representation in the skilled trades. The CAF report (2023) does not report representation of other gender identities in the trades. 2.1% of participants were Indigenous compared to 5.8% of Red Seal skilled trades workers in Canada; 13.2% of participants were visible minorities compared to 18.2% of Red Seal skilled trades workers (CAF, 2023). This underrepresentation may be related to the distribution of demographics across different trades, as diversity in trades specialities varies significantly (CAF 2023; Su *et al.*, 2024). Alternatively, underrepresentation may be related to the regional specificity of the study, which was conducted in Southern Ontario, while the Red Seal Report presents national averages (CAF, 2023).

Apprentices with a disability were more likely to be non-male, Indigenous or a visible minority, and to be enrolled in day-release training. The prevalence of disability was over two times higher among females, and over three times higher among transgender and non-binary participants than male participants. The disability prevalence was two times higher among

Indigenous than non-Indigenous apprentices, and 1.6 times higher among visible minority than non-visible minority apprentices. Detailed disability demographics on skilled tradespeople by gender or other characteristics are not available (CAF 2023; Su et al., 2024; Hardy and Vergara, 2025).

The disability prevalence among Canadians aged 15 years and over increased significantly between 2017 and 2022 (Statistics Canada, 2023; CSD 2017; CSD, 2023). Prevalence increased most among youth ages 15-24, followed by adults, aged 25-64, but remained highest among adults aged 65 and over (Statistics Canada, 2023). Employment among working-age adults with a disability declined significantly from 78% in 2017 to 62% in 2022; employment for adults without a disability increased slightly during this period (Statistics Canada, 2023). 20.1% of apprentices in this study reported a disability, indicating moderate representation compared to 27% of working-age adults in Canada in 2022 (Hebert *et al.*, 2024).

Learning and Working in Skilled Trades with a Disability

Nearly three-quarters of apprentices with a disability reported that their disability did not affect their ability to learn or work. More than half of apprentices with each impairment reported no effect on their work, except for vision impairment, where effects were more common. These findings may indicate that work in the skilled trades interacts differently with various impairments, exacerbating barriers to entry for some groups. This pattern has been observed in broader employment contexts (Vornholt *et al.*, 2018; Padkapayeva *et al.*, 2017) and within the trades (Jones 2024). By identifying the disability types most affect learning and working, targeted accommodation strategies can be developed to enhance workforce engagement (Padkapayeva *et al.*, 2017).

Evidence suggests that lack of safety knowledge, training, or familiarity may affect OHS-related decision-making and increase the risk of workplace injuries (Teufer *et al.*, 2019). Research examining barriers to employment for persons with disabilities identified self-esteem as a key barrier across both physical and cognitive impairments (Shier *et al.,* 2009). While prior literature has focused on employers underestimating the skills or knowledge of employees with disabilities (Shier *et al.,* 2009), these results suggest that apprentices may also lack confidence

in their own OHS knowledge. Ability to find additional OHS information was lower among both groups, with approximately 80% of apprentices expressing confidence in this skill. The qualitative findings of this study recommended providing additional resources, which could support learning for all apprentices (Lovett et al., 2021).

The values where apprentices with disabilities reported lower belief aligned with the domains where apprentices with disabilities reported lower knowledge. This pattern may be linked to self-esteem (Shier *et al.*, 2009), suggesting that lower perceived value of OHS training may stem from broader issues of self-confidence among apprentices with disabilities. No significant differences were observed between the two groups for the belief that OHS training improves performance and productivity. Both groups reported lower levels of agreement (i.e., approximately 80%) endorsing this value. Despite extensive evidence of the relationship between OHS and productivity (Lamm et al., 2007), apprentices may be unaware this is a value of OHS. Increasing awareness of the benefits of OHS training may foster greater engagement in safety practices among apprentices.

Apprentices with disabilities were significantly more likely to report experiencing workplace injuries, especially serious injuries, in the past 12 months than their peers without a disability. The relationship between an apprentice's disability status, OHS training, and risk of workplace injury is well documented. The Government of Canada's Disability Management Program (2019; Nevala *et al.*, 2015; CAF, 2009) outlines that the risk of workplace injury increases without appropriate accommodations. Therefore, the accommodations outlined in this research become increasingly essential components of OHS training in the skilled trades.

While long-term musculoskeletal disorder symptoms or pain profiles were similar between the two groups, short-term and chronic pain profiles varied significantly. The reason for this variation is unclear but may relate to how participants with a disability define or experience pain, or how those without disabilities anticipate recovery from temporary ailments. Participants with a mobility impairment were not excluded from pain analyses, meaning their pain may stem from their condition rather than apprenticeship work. However, the cause of pain was not asked, so excluding this group could have omitted relevant non-conditional-related pain. Considering this, these findings should be interpreted with caution.

Apprentices with and without a disability overwhelmingly preferred hands-on-learning over other strategies. These findings align with previous research showing higher ratings of instructor effectiveness, learning strategies, and overall effectiveness of OHS training among construction workers who received face-to-face, hands-on training compared to those in distance learning formats (Sarpy et al., 2021).

Based on the literature, tradespersons with disabilities may not request accommodations due to: low self-esteem or underestimation of their own abilities (Shier *et al.*, 2009); concerns about negative attitudes toward workers with a disability (Shier *et al.*, 2009; Vornholt *et al.*, 2018; Nevala *et al.,* 2015); perceived barriers to implementing accommodations (Vornholt *et al.,* 2018); doubt about the effectiveness of interventions (Jones 2023); fear of damaging learning relationships (Brown *et al.,* 2024; CAF 2009); concerns that accommodation may widen learning-equity gaps (Lovett 2021); worry about being treated as a homogenous group (Cocks *et al.,* 2015); challenges in learning to use assistive technology (Nevala *et al.,* 2015); or lack of union support during apprenticeship phases (Richards and Sang, 2016). The diversity of accommodations described by participants underscores the importance of collaboratively designed, personalized supports (Richards and Sang, 2016).

Study Implications

Findings from this research highlight differences in knowledge, values, application, and outcomes of OHS training among apprentices with disabilities and those without. Inclusive practices in the skilled trades must prioritize personalized and proactive accommodations, as some impairments, such as vision- or mobility-related, pose greater barriers. Training providers and employers should identify impairment-specific barriers and collaboratively design appropriate supports. To address knowledge differences and perceived value of OHS training among apprentices with disabilities, programs should integrate strategies like mentorship, provide accessible resources in multiple formats, and emphasize the broader benefits of safety training, including injury prevention and improved productivity. Given the higher odds of serious workplace injuries among apprentices with disabilities, inclusive safety practices should include early co-identification of accommodations and regular safety check-ins.

Future Research

The current gap in demographics of skilled tradespeople with disabilities represents a critical gap in research that should be addressed, as understanding the demographics of the skilled tradesperson population with disabilities is essential for the targeted implementation of accommodations (Nevala *et al.,* 2015; Padkapayeva *et al.,* 2017). Future research should further explore how intersectional identity factors, such as race, ethnicity, age, socioeconomic status, and immigration status, intersect with disability to influence training, including OHS training. Such analyses are essential for developing meaningful accommodations and OHS training plans, including injury prevention strategies, to effectively support inclusive apprenticeships.

Future research should explore the barriers to entry for various impairments, which would provide valuable insights for designing inclusive apprenticeship pathways. Relatedly, future research should investigate disability-specific accommodations that apprentices recommend for training and investigate trade-specific accommodations. For example, it would be valuable to understand the accommodations that are supportive for apprentices with a visual impairment compared to a hearing impairment and to understand accommodations that are supportive for plumbing apprentices compared to carpentry apprentices. Longitudinal studies that investigate training accommodations for apprentices with a disability and their long-term workplace outcomes, job satisfaction, and job retention, would extend the current understanding and support development of causal relationships.

Guidance documents about recommendations for hiring people with disabilities in the skilled trades are needed to help organizations strengthen their capacity for inclusive workforce integration. These trade-specific guidelines would serve as a launching pad for organizations to strengthen their capacity to hire skilled trades workers with disabilities in the future.

Study Limitations

As a preliminary study of apprentices with disability and their OHS experiences, this study provides important insights and contributes to the growing knowledge base in this area. Limitations of this study fall into two main categories: participant characteristics and questionnaire design. All participants were recruited from one region, which may limit the external validity to other regions; however, this study provides a good exploratory assessment of this population, which informs future studies that aim to produce more generalizable results. It is unclear whether part-time students were adequately represented, as these questions were not included, which may impact the prevalence estimates for disability if

apprentices with disabilities disproportionately enroll in part-time studies. The study did not include measures for chronic health conditions or mental health-related disabilities, which may have influenced the results, as these are common categories of disabilities (Statistics Canada, 2025; Statistics Canada, 2023). The sample included relatively few older and non-male apprentices, making it difficult to determine whether the observed patterns apply broadly across diverse demographic groups; however, this is generally representative of the skilled trades apprentice population. The questionnaire relied on a long recall period, which increases the risk of recall bias. Measures of pain and injury were self-reported, which may not align with clinical or workplace records. The questionnaire did not include questions about instructor experiences, the accessibility of OHS training materials, or workplace culture, which may have provided additional insights into these findings. Finally, the study collected cross-sectional data, which limits the ability to establish casual relationships or to measure changes overtime, such as in OHS knowledge, or pain and injury. Cross-sectional data collection can serve several purposes, including the development of new hypotheses and the simultaneous measurement of multiple exposures and outcomes (Da Cruz Figueiredo et al. 2025). This is particularly valuable for early-stage research in emerging areas of inquiry, such as this one.

CONCLUSIONS AND APPLICATION OF FINDINGS

This research offers valuable insights into how apprentices with disabilities experience OHS training and provides recommendations for enhancing training. Apprentices with disabilities expressed a shared preference with their peers for hands-on-learning approaches to OHS topics. They also identified specific accommodations, primarily related to physical access, resources, and learning styles, that enhance their OHS training and application in both classrooms and workplaces. The diversity of needs and perspectives among apprentices with disabilities underscores the essential need to prepare accommodations collaboratively with apprentices, tailored to individual needs.

These findings will inform how skilled trades training providers, program developers, instructors, and apprentices engage with OHS training for persons with disabilities. Instructors and program developers are encouraged to work with apprentices with disabilities to co-create individualized accommodation strategies and plans that support their learning. Skilled trades training providers should establish support systems and transition plans that facilitate accommodations in workplaces, ensuring the health and safety of all workers.

The findings from this research support the shared responsibility for training across the spectrum of actors, including but not limited to, instructors and curricula developers, apprentices, workplaces, and legislative and policy bodies. There is a need for broader systems-level change that addresses the implications of this work within skilled trades training. Adjustments to the OHS legislation regarding workplaces and that for training providers should be enhanced to include collaborative efforts to support and accommodate apprentices with disabilities to enhance safety for all workers on a job site.

Underutilized Talent: Assessing Employer Preparedness to Include Persons with Disabilities in the Canadian Skilled Trades

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ABSTRACT

Persons with disabilities are an underappreciated source of workers in the Canadian economy, especially among skilled trades, where only 13.8% of workers identify as a person with a disability. This survey of skilled trades companies across Canada aimed to understand the barriers and informational needs that prevent companies from implementing equitable employment practices.

A cross-sectional, quantitative survey was distributed to eligible companies to elicit insights related to current worker demographics and readiness to provide accommodations for workers. Multivariable logistic regression models were fit to assess differences in accommodation readiness for various impairment types.

Most respondents reported their companies were unprepared to accommodate vision impairments (85%) and mobility impairments (79%). When controlling for province and company size, construction sector companies were significantly less prepared to accommodate mobility impairments (OR=0.316; p=0.047) and hearing impairments (OR=0.202; p=0.003) compared to other skilled trades sectors. Larger companies were significantly more prepared to accommodate mobility (OR= 3.771, p=0.043) and learning (OR= 5.425, p=0.002) impairments.

Overall, findings indicate that many Canadian skilled trades companies remain insufficiently prepared to accommodate several impairment types or implement common accommodations for employees with disabilities. This work will provide foundational evidence for future assessments aimed at identifying factors that improve organizational capacity to meaningfully, purposefully, and equitably integrate persons with disabilities into the skilled trades workforce in Canada.

KEYWORDS

Skilled trades; disability inclusion, vision impairment; hearing impairment; mobility impairment; cognitive impairment; speech impairment; equitable employment practices; employer readiness, workplace accommodation

INTRODUCTION

In 2021, approximately 1.6 million Red Seal certified skilled trades workers were employed in Canada, down 5.7 percentage points from 2016 (Su et al., 2024). The Red Seal program sets the national standard across roughly 50 trades and enables interprovincial mobility and mutual recognition of certification (Government of Canada, 2017). As Canada's trades workforce ages, further declines are expected; notably, the number of workers aged 45-54 fell by more than a 20% over this period, reflecting smaller cohorts advancing through age brackets (Su et al., 2024). In response, trades professions are designing recruitment strategies to reach untapped talent, including secondary students (i.e., ages 14-19; Alphonso, 2024; Hill and Liberty, 2025). Skilled trades remain viable path; using data from over 61,000 Canadian students, Milian et al. (2025) estimated that Red Seal certified workers earn higher average annual incomes than peers who attended college or university. Yet risks to retention persist: burnout prevalence among Ontario electricians was estimated 31.8% and lower job satisfaction was associated with grater intention to leave the trade (Shahzad et al., 2026). Sustainable recruitment and employment frameworks will therefore be essential to maintain participation in the skilled trades labour force.

Against this backdrop of workforce decline and retention pressures, broadening participation to underrepresented groups, including persons with disabilities, represents a timely, pragmatic strategy to sustain and stabilize the skilled trades workforce. Enhancing inclusion and accommodation may also contribute to retention by improving job fit with capacity, perceived fairness, and organizational climate. Equitable employment opportunities for persons with disabilities in the skilled trades have not been achieved. In 2021 272,800 Red Seal certified workers in Canada identified as a person with a disability, defined as often or always experiencing difficulties with activities of daily living, such as seeing, hearing, walking, or learning (Canadian Apprenticeship Forum (CAF), 2023). These workers represent only 13.8% of the Red Seal certified skilled trades workforce in Canada, five percentage points less than the employment rate of persons with disabilities for all occupational sectors (CAF, 2023; Su et al., 2024). The percentage of skilled trades workers who identified as a person with a disability was higher than the overall skilled trades average

in oil and solid fuel heating (i.e., 17.6%), automotive parts (17.2%), baking (16.6%), cooking (16.2%), metal and platework fabrication (15.2%), heavy equipment operation (15.3%), and painting and decorating (15.2%) trades (CAF, 2023). The proportion of the general population who identified as persons with disabilities varied by province and territory but increased in all regions by 1.1 to 8.6 percentage points from 2016 to 2021 (Statistics Canada, 2023). Skilled trades employment for persons with disabilities also varied by province, with higher proportions in the Maritime provinces (i.e., 18.1%) compared to Ontario (13.5%) and Quebec (11.1%) (CAF, 2023). Taken together, these figures underscore a sizeable, underutilized talent pool and motivate a closer examination of employer readiness to enable equitable participation.

Differences in rates of employment among persons with disabilities and their counterparts without a disability are multifaceted and cannot be attributed to a single factor. However, experiences of discrimination play a substantial role in the career trajectories of persons with disabilities (Nittrouer et al., 2024). While some positive employment experiences among persons with disabilities are documented in the literature (Stokar and Orwat, 2018; Richards and Sang, 2015), they are less common than negative experiences and are often described in the context of the persistence of barriers and challenges. For example, Richards and Sang (2015) describe a positive response to an inclusion initiative for transportation workers with neurological impairments or who were neurodiverse in the United Kingdom, however, even these experiences were contextualized by prior negative experiences or gaps in inclusive employment practices. Similarly, Stokar and Orwat (2018) describe generally positive relationships between deaf restaurant workers and their managers without hearing impairment in the United States; however, the managers were considered unknowledgeable about the accommodation needs and abilities of their employees. In contrast, outright negative experiences marked by discrimination, biases, and lack of accommodation were common (Groschl, 2007; Nittrouer et al., 2024; Gupta et al., 2021; Soeker et al., 2018). Groschl (2007) described how aesthetic biases negatively impacted the hiring practices in the hotel industry in Canada. Discriminatory hiring practices against workers with mental impairments in the United States were described by Nittrouer et al. (2024) as stigmas that were “relatively automatic, negative biases;” stigmas toward some

invisible impairments were sometimes exacerbated compared to visible impairments. For those who were working, a barrier described by persons with disabilities in South Africa was related to feeling they had reached a limit or ceiling in their training imposed by others indicating they felt they were not welcome to participate in higher levels of training or work, with discrimination limiting their ability to advance (Soeker et al., 2018). Domestically, Gupta et al. (2021), noted that 75% of eligible workers with vision impairments were out of the labour force when surveyed, noting the primary barriers were the lack of available employment opportunities, inadequate training, and unsuccessful attempts to seek employment previously. In Gupta's study, 25% of participants noted that discrimination was the primary reason they could not advance and 45% described discrimination as the primary factor that disadvantaged them throughout their career. Although several of these studies draw on only some very specific contexts (e.g., hospitality, food service), they illuminate mechanisms, such as stigma, aesthetic bias, and limited accommodation literacy, that plausibly operate within skilled trades workplaces and may contribute to observed disparities.

Literature that describes experiences of discrimination and employment barriers for persons with disabilities underscores the dramatic and pressing need for inclusive hiring practices, including within the skilled trades (De Raaf et al., 2024). Inclusive pathways into skilled trades have been described as requiring elements such as employer capacity for apprenticeship training and supports that are open and inclusive, on-site job training that supports inclusion for diverse apprentice populations, and long-term employment settings that are inclusive and offer ongoing accommodation (De Raaf et al., 2024). However, the ability to accommodate and to develop and implement inclusive hiring practices varies across company characteristics, such as company size (Bruyere et al., 2006; Macpherson et al., 2022; Jasper and Waldhart, 2013) and access to accommodation resources and opportunities (Groschl, 2007). Informational gaps persist regarding how employers in different skilled trades sectors develop, resource, and operationalize inclusive hiring and accommodation practices. Additionally, sector-specific differences influence the readiness of companies to employ persons with disabilities, such as a knowledge gap that persists within the construction sector compared to other sectors (Bailey et al., 2022). Ongoing issues

with lack of equity and diversity in the construction industry have been well documented, warranting two special issues of the Construction Management and Economics journal in 2005 (Dainty and Baglihole, 2005) and 2013 (Powell and Sang, 2013). Despite the salience of these issues, there is limited national-level evidence on employers' readiness to accommodate diverse impairment types within the skilled trades, and on sector-specific differences after accounting for company size and province. This represents a critical evidence gap with direct implications for policy and practice.

To address this gap, we conducted a national cross-sectional survey of skilled trades employers to characterize current worker demographics and assess "accommodation readiness" across impairment types. Multivariable models were used to examine sectoral differences while controlling for province and company size. This study aimed to describe the current landscape of skilled trades employment across the construction, automotive power, industrial, and service sectors for persons with disabilities and identify sector-specific readiness to meet the needs of employees with various impairments. Specifically, this paper aimed to:

i) Describe and characterize the employment of persons with disabilities across skilled trades sector companies in Canada;

ii) Identify the informational needs of companies across the skilled trades to develop inclusive procedures that may help overcome the barriers to equitable employment practices;

iii) Assess the readiness of skilled trades companies to accommodate various impairment types and determine factors that influence the ability of companies to readily accommodate employee needs; and

iv) Evaluate the feasibility for companies to implement common accommodations when requested.

Collectively, these objectives position the study to generate actionable, sector-specific insights to inform employer guidance, training, and policy interventions.

METHODS

Study Design and Approach

This study reports findings from a cross-sectional quantitative survey examining the perspectives and practices of Human Resources (HR) professionals and company owners in the Canadian skilled trades sector. A non-probabilistic sampling approach was used, and all responses were anonymous. The survey aimed to identify challenges related to attracting, hiring, and retaining persons with disabilities in the skilled trades, as well as assess organizational practices, resources, and levels of preparedness to accommodate employees with disabilities. Skilled trades were defined to include the construction, motive power, industrial, and service sectors. This design enabled a broad snapshot of employer readiness across diverse organizational contexts.

Ethics approval was obtained from the Research Ethics Board at Conestoga College Institute of Technology and Advanced Learning (REB #603). All participants provided written informed consent.

Target Population

The target population comprised HR professionals and company owners employ at organizations with skilled trades workers. Eligible participants were required to represent a Canadian company operating within the skilled trades and to have sufficient knowledge of organizational hiring, accommodation, or workforce practices. While recruitment messaging focused on HR professionals, hiring managers, health and safety representatives, and company owners, individuals in other roles were not excluded if they possessed adequate organizational insight. The survey was offered in English and open nationwide, allowing participation from respondents involved in workplace decision-making and accommodation processes.

Survey Development

The survey instrument was developed iteratively, drawing on existing literature, exploratory research (Bishop-Williams et al., under review), and partner input. A Project Advisory Committee composed of individuals with lived experience of disability and professionals supporting persons with disabilities in skilled trades, provided guidance throughout development. This involvement helped ensure the clarity, relevance, and practical applicability of survey items and strengthened face validity.

The survey was administered online using Qualtrics (Qualtrics, Provo, UT, USA) and was pre-tested with approximately 30 individuals from targeted population to assess clarity, navigation, and completion time. Revisions were made based on feedback. The final survey was designed to be brief; the average completion time was 12 minutes and 32 seconds, excluding three cases with extended pauses.

Survey content included organizational characteristics (sector, company size, and proportion of employees identifying as persons with disabilities) and focused on employer needs related to inclusive hiring, perceived barriers to hiring persons with disabilities, and organizational readiness to provide workplace accommodations across impairment type. Questions also assessed attitudes toward hiring, retaining, and advancing employees with disabilities in skilled trades. Accommodation readiness was examined across five impairment categories: hearing, mobility, vision, cognitive/ learning, and speech impairments.

Survey Recruitment

Recruitment involved multiple outreach strategies, including social media posts, email newsletters distributed by HR and skilled trades employer organizations, direct emails to known skilled trades employers, and direct email outreach sent to employers identified through publicly available contact information (e.g., websites and online directories). Recruitment materials requested that recipients forward the survey link to the individual within their organization most qualified to respond, such as the company owner or Director of HR. No financial or other incentives were offered for participation. This multi-modal strategy helped increase reach across sectors and regions despite the non-probabilistic sampling approach.

Descriptive Analysis

Descriptive analyses summarized participant and company characteristics. Frequencies and percentages were estimated for all quantitative survey responses. Distributions of company characteristics among completed survey responses and all (i.e., abandoned and completed) survey responses were compared by Chi-square (x2) tests.

Participants responded to eight statements about hiring and retaining persons with disabilities in the skilled trades. Statements reflected common opinions or misconceptions of employers that may influence inclusive HR practices for persons with disabilities. Responses were scored on a 5-point Likert scale from strongly agree to strongly disagree. These items

were intended to capture attitudinal factors that may shape organizational decision-making around disability inclusion.

Statistical Analyses

Based on sample distribution, responses were classified by province as “Ontario” and “Other Provinces,” by skilled trades sector as “Construction” and “Other Sectors,” and by company size as “Less than 50” and “50 or More” for logistic regression analyses. To assess accommodation readiness, responses were dichotomized as “Prepared to Accommodate” (collapsing “Very Prepared” and “Somewhat Prepared”) and “Not Prepared to Accommodate” (collapsing “Not Prepared” and “Accommodating this impairment would be impossible”) =. These categories simplified interpretation and reflected practical differences in organizational readiness. Percentages were estimated to examine the relationship between skilled trades sector (i.e., Construction or other), province (i.e., Ontario or other), or company size (i.e., less than 50 and 50 or more) and organizational readiness to accommodate each assessed impairment type. Then adjusted logistic regression models were estimated. In total, five logistic regression models were fit: one adjusted model each for the five impairment types. Adjusted odds ratios (AORs) controlled for theoretically and empirically relevant covariates, specifically sector, province, and company size. Ontario was included to account for variation in disability-related legislation and accommodation requirements across jurisdictions (Kovacs Burns et al., 2010; Bishop-Williams et al., under review). Company size was considered a covariate to account for documented differences in workplace disability experiences (Macpherson et al., 2022), access to accommodation resources and opportunities (Groschl, 2007), and occupational health and safety practices (Gibb et al., 2017), organizational concerns (Jasper and Waldhart, 2013) and return to work procedures (Macpherson et al., 2022). Interaction terms (e.g., sector × size) were examined but not retained due to sample size limitations..

All statistical analyses were conducted in Stata version 19 (StataCorp LLC, College Station, TX, USA). Results are reported as AORs with 95% confidence intervals (95% CI; i.e., an alpha of 0.05 was used throughout). Multivariable models were assessed to ensure assumptions were met (i.e., observations were independent and outcome was binary) and that cell counts were reasonable (i.e., no cell counts were less than 5). Model diagnostics were minimal as predictors were binary (i.e., sector: Construction compared to all others; province: Ontario compared to all others; company size: less than 50 compared to 50 or more). Each multivariable model was assessed for Variance Inflation Factor (VIF), Likelihood Ratio Test (LRT) against the null model (i.e., sector only), and Hosmer-Lemeshow Goodness of Fit (GOF, with 10 bins). No major violations were identified.

RESULTS

Recruitment

Across all distribution channels, the survey was distributed to over 5,000 companies that employ skilled trades workers across Canada and resulted in 251 clicks to the survey. The survey's non-probabilistic recruitment means that the survey frame cannot be well defined; characteristics of companies that did not click to open the survey are not available. The survey was open from October 5, 2025, to January 15, 2026. In total, 162 respondents provided consent to participate and initiated the survey. Company demographics were completed by 141 company respondents. Among the 141 respondents who completed the demographics portion of the survey, three (2.1%) reported not employing skilled trades workers; these respondents were ineligible for the study and excluded from further participation.

Following the demographics section of the survey, questions focused primarily on current disability employment characteristics within each company. Nearly all partially complete surveys were abandoned at some point in this section. In total, 91 surveys, each representing a unique company across the country, were completed and included in this analysis. All questions in the survey were voluntary; counts of responses for each question are provided in the tables and figures. The pattern of survey attrition suggests that questions about disability employment practices may have required more detailed organizational knowledge or may have been considered sensitive for respondents.

Company Characteristics

Completed survey responses were distributed across provinces/ territories, sector, companies with one or more sites (i.e., multisite), and company size (Table 1). Companies that completed the survey primarily represented Ontario (50.6%), construction sector (65.9%), single-site companies (68.1%), and small-to-medium sized companies (e.g. 5 to 50 employees; 42.9%). Company characteristics from completed responses did not statistically differ from company characteristics from incomplete responses. This similarity suggests

minimal nonresponse bias amongst companies that abandoned the survey with respect to core organizational demographics, although it does not speak to companies that did not open the survey or complete the demographics questions and does not address potential response biases related to social desirability or interest in the topic.

Table 1. Company characteristics from complete and incomplete responses to the survey of employers of skilled trades people, from October 2025 to January 2026, with statistical comparison of differences in respondent groups by Chi-square (x2) test.

First Company Characteristics	Second Company Characteristics	Complete responses (only)	Complete responses (only)	Incomplete responses	Incomplete responses	Differences between respondents and incomplete responses
Province/ Territory	British Columbia	8	8.8	3	6.0	$X^2 = 11.44$ p= 0.324
	Alberta	10	11.0	5	10.0	$X^2 = 11.44$ p= 0.324
	Saskatchewan	5	5.5	3	6.0	$X^2 = 11.44$ p= 0.324
	Manitoba	9	9.9	1	2.0	$X^2 = 11.44$ p= 0.324
	Ontario	46	50.6	21	42.0	$X^2 = 11.44$ p= 0.324
	Quebec	1	1.1	2	4.0	$X^2 = 11.44$ p= 0.324
	New Brunswick	2	2.2	3	6.0	$X^2 = 11.44$ p= 0.324
	Nova Scotia	6	6.6	2	4.0	$X^2 = 11.44$ p= 0.324
	Prince Edward Island	1	1.1	1	2.0	$X^2 = 11.44$ p= 0.324

	Newfoundland & Labrador	2	2.2	5	10.0	$X^2 = 11.44$ p= 0.324
	Nunavut, Northwest Territories, and Yukon	1	1.1	0	0	$X^2 = 11.44$ p= 0.324
Sector	Accommodation and Food Services	1	1.1	2	4.0	$X^2 = 5.779$ p= 0.449
	Construction	60	65.9	29	58.0	$X^2 = 5.779$ p= 0.449
	Electricity, Gas, Water and Waste Services	5	5.5	5	10.0	$X^2 = 5.779$ p= 0.449
	Manufacturing	8	8.8	3	6.0	$X^2 = 5.779$ p= 0.449
	Services	9	9.9	2	4.0	$X^2 = 5.779$ p= 0.449
	Transportation and Warehousing	1	1.1	1	2.0	$X^2 = 5.779$ p= 0.449
	Other	7	7.7	7	14.0	$X^2 = 5.779$ p= 0.449

Multisite	No	62	68.1	38	76.0	$X^2 = 1.364$ p= 0.506
	Yes	28	30.8	11	22.0	$X^2 = 1.364$ p= 0.506
	Unsure	1	1.1	1	2.0	$X^2 = 1.364$ p= 0.506
Company Size	Less than 5 employees	12	13.2	8	16.0	$X^2 = 1.968$ p= 0.742
	5-50 employees	39	42.9	25	50.0	$X^2 = 1.968$ p= 0.742
	51-100 employees	12	13.2	4	8.0	$X^2 = 1.968$ p= 0.742
	101-500 employees	16	17.6	6	12.0	$X^2 = 1.968$ p= 0.742
	More than 500 employees	12	13.2	7	14.0	$X^2 = 1.968$ p= 0.742

Disability Employment Characteristics

27.3% of companies reported that they currently employed at least one trades worker with a disability (Table 2). Most companies (73.4%) reported that less than 1% of their current workforce identified as a person with a disability. Only 18.2% of companies surveyed reported that they had knowingly hired a person with a disability in the past 12 months. When asked if their company actively recruited persons with disabilities for skilled trades positions, 11.4% of companies reported doing so. However, when asked how companies actively recruit persons with disabilities, no responses were provided (i.e., n=0). This gap between stated recruitment intentions and actual strategies highlights an operational disconnect from inclusive hiring practices.

Table 2. Reported disability employment characteristics from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Disability Employment Characteristics	Response	Frequency	Percentage (%)
Currently Employ Skilled Trades Workers with Disabilities (n=88)	Yes	24	27.3
	I don't know	7	7.7
	No, not to my knowledge	57	64.8
Proportion of Skilled Trades Employees with a Disability (known to employer) (n=64)	Less than 1%	47	73.4
	1-2%	12	18.8
	2-5%	3	4.7
	More than 5%	2	3.1
Have Hired a Skilled Trades Worker with a Disability in the Past 12 Months (n=88)	Yes	16	18.2
	I don't know	9	10.2
	No, not to my knowledge	63	71.6
Actively Recruiting Skilled Trades Worker with Disabilities (n=88)	Yes	10	11.4
	I don't know	16	18.2
	No, not to my knowledge	62	70.5

Information Needed

The types of information needed for developing inclusive hiring practices for persons with disabilities and for hiring, retaining, and advancing persons with disabilities at skilled trades companies was distributed similarly (Figure 1). In both instances, the most needed information was related to the types of accommodations available to support a person with disability (n= 58 of 80; n= 59 of 88, respectively). Other frequently needed information included the impacts on worker productivity (n= 47 of 80; n= 45 of 88); cost-benefit analysis of hiring persons with disabilities (n= 42 of 80; n= 53 of 88); and cost of accommodation (n= 40 of 80; n= 51 of 88). While less frequently requested than the information types listed above, nearly one-third of respondents reported needing information about increasing retention rates of persons with disabilities (n= 28 of 80; n= 31 of 88) and how to promote persons with disabilities to advance their career (n= 23 of 80; n= 31 of 88). The close alignment between these informational needs suggests that employers view inclusive hiring, retention, and advancement as interconnected challenges rather than isolated issues.

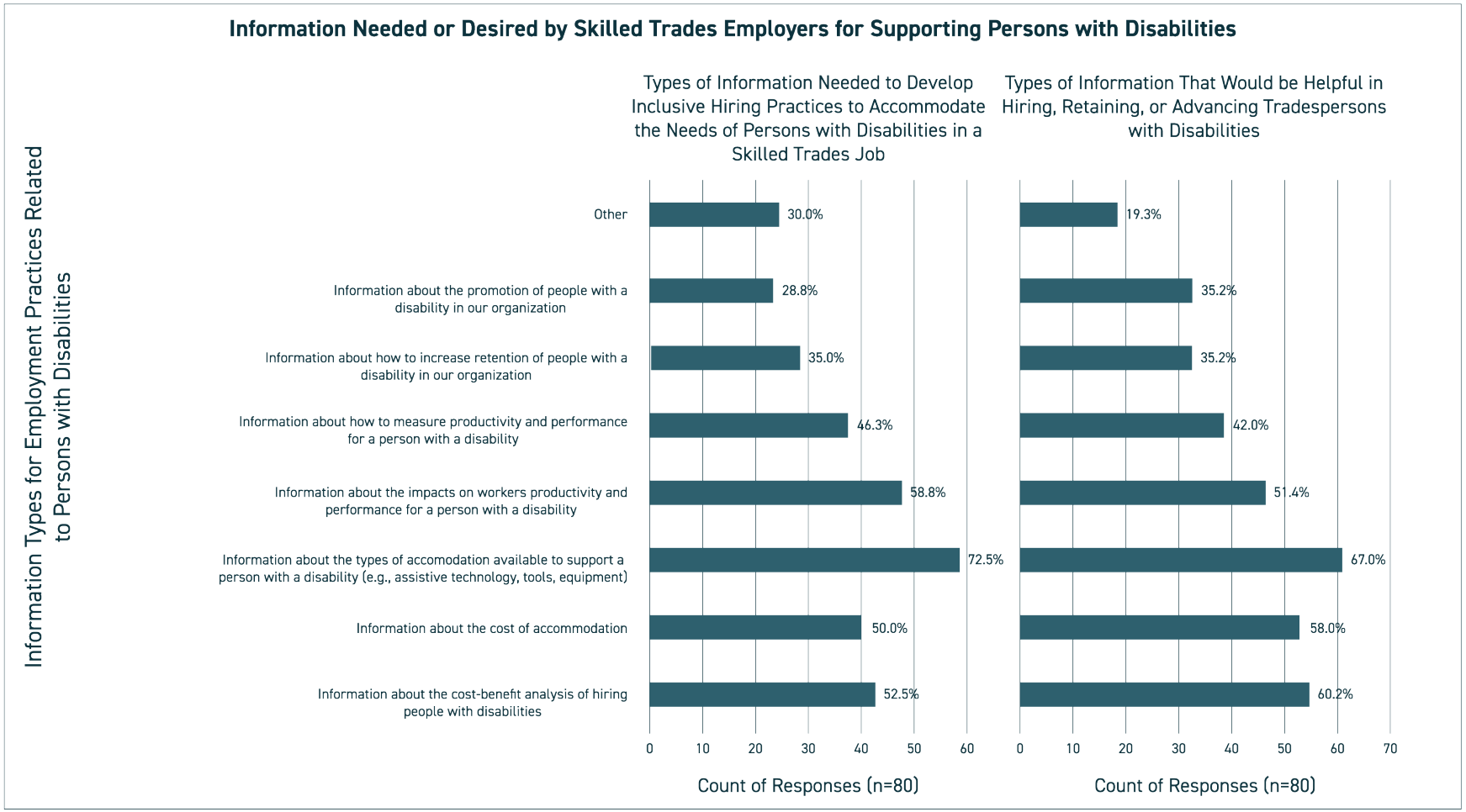

Figure 1. Percentage of companies reporting information needed for developing inclusive hiring practices for persons with disabilities and for hiring, retaining, and advancing persons with disabilities from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Related to inclusive hiring practices, most companies reported that they agreed or strongly agreed that their company's hiring practices focused on finding the best person for the job, regardless of their disability status (n=65, 82.3%). However, most companies also agreed or strongly agreed that they 'rarely receive job applications from persons with disabilities' so these practices do not impact their organization, although companies were not asked how they determined this (n=64, 82.1%). Despite the needs for information (Figure 1) and the statements above, only 17.1% (n=12) of respondents disagreed that their workplace provides equal opportunities for persons with disabilities. This discrepancy indicates that many employers perceive their practices as equitable while simultaneously acknowledging low application rates and limited knowledge regarding accommodations.

Organizational Barriers to Hiring Persons with Disabilities

Organizational barriers present hurdles that prevent companies from accessing and attracting large portions of the skilled trades workforce. In total, 50-80% of companies identified each specific hiring-related barrier investigated as a challenge (i.e., major challenge or somewhat of a challenge) for their company (Figure 2). The most noted challenge was organizational concern about the applicant's functional ability to perform required duties (n=74, 81.3%) followed by organizational concern about the applicant's ability to work safely (n=61, 67.0%). Findings related to organizational concerns about safety were substantiated by 47.8% of participants agreeing or strongly agreeing that the organization sees employing persons with a disability as a major risk for the employer (neutral= 22, 31%; disagree or strongly disagree=15, 21.1%). The least common barrier in the skilled trades was supervisor discomfort in managing persons with disabilities at the company (n=48, 52.2% of companies reported this barrier).

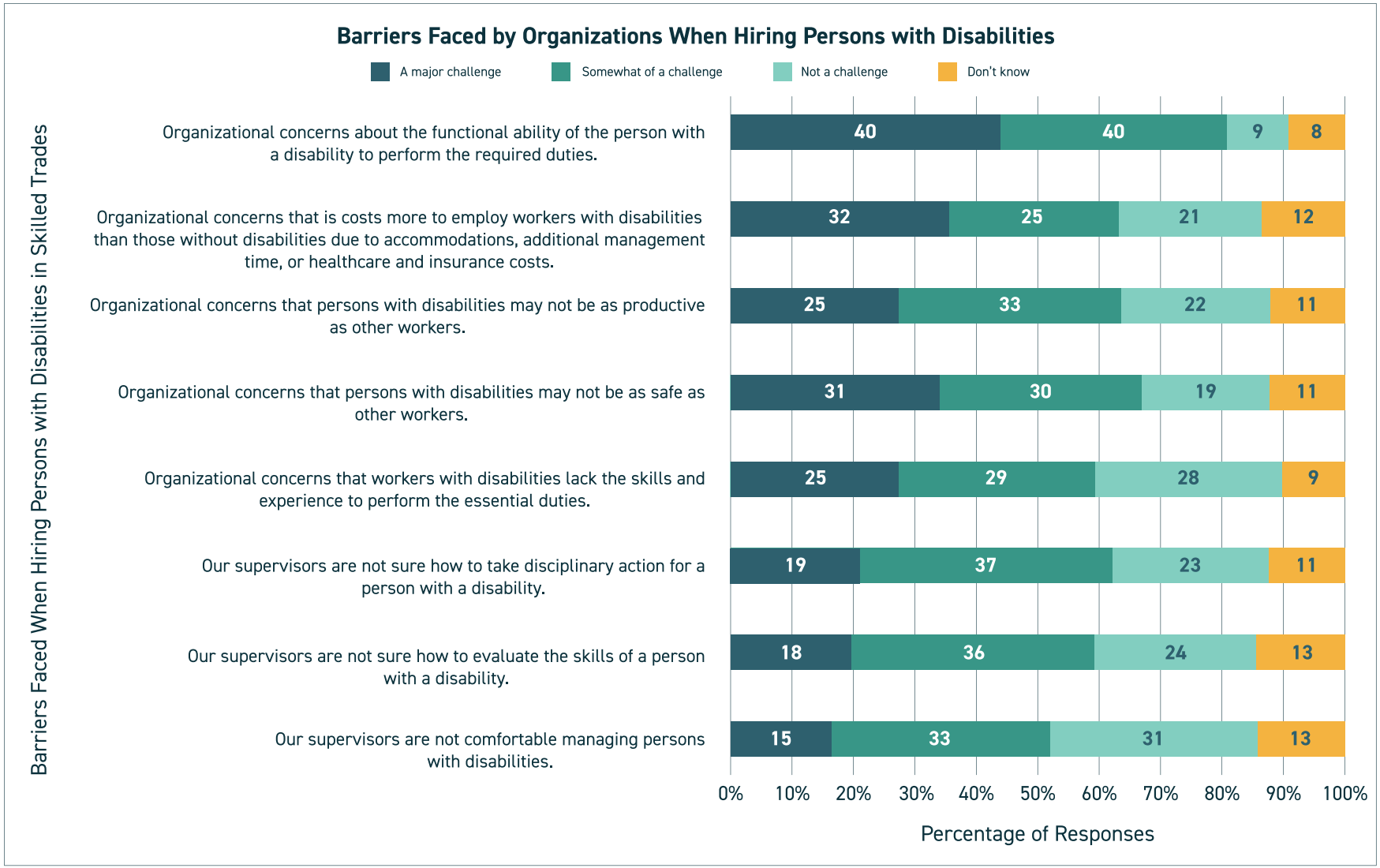

Figure 2. Frequency and percentage of barriers faced when hiring persons with disabilities from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Barriers related to cost and productivity also surfaced. Respondents agreed or strongly agreed (n=26, 39.4%; compared to n=11, 16.7% disagreed or strongly disagreed) that they expected accommodating an employee who becomes disabled will cost less than supporting a new employee who requires accommodation. Further, respondents mostly agreed or strongly agreed (n=31, 46.3%; compared to n=23, 34.3% disagreed or strongly disagreed) they expected employees with a disability would be less productive than their peers. Together, these findings point to pervasive misconceptions about safety and productivity that may deter employers from pursuing inclusive hiring strategies.

Accommodation and Changes to Support Persons with Disabilities

Across impairment types, less than half of all companies were prepared to accommodate each disability, excluding speech impairments. Respondents most often reported that vision (n=44, 51.8%) and mobility (n=40, 47.1%) impairments were impossible to accommodate (i.e., “Accommodating this impairment would be impossible in our organization”). A small number of employers reported being very prepared to accommodate speech impairments (n=7, 8.5%) and overall, less than 10% of companies reported that they were very prepared to accommodate any impairment type.

Table 3. Reported preparedness to accommodate each impairment type from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Preparedness to Accommodate	Impairment Type: Mobility n (%)	Impairment Type: Hearing n (%)	Impairment Type: Vision n (%)	Impairment Type: Learning n (%)	Impairment Type: Speech n (%)
Not Prepared	Impossible 40 (47.1) Not Prepared 27 (31.8) N (%) 67 (78.8)	Impossible 19 (23.5) Not Prepared 24 (29.6) N (%) 43 (53.1))	Impossible 44 (51.8) Not Prepared 28 (32.9) N (%) 72 (84.7.8)	Impossible 15 (18.8) Not Prepared 27 (33.8) N (%) 42 (52.5)	Impossible 14 (17.1) Not Prepared 18 (22) N (%) 32 (39.0)
Prepared	Somewhat Prepared 15 (17.7) Very Prepared 3 (3.5) N (%) 18 (21.2)	Somewhat Prepared 33 (40.7) Very Prepared 5 (6.2) N (%) 38 (46.9)	Somewhat Prepared 12 (14.1) Very Prepared 1 (1.2) N (%) 13 (15.3)	Somewhat Prepared 32 (40) Very Prepared 6 (7.5) N (%) 38 (48.2)	Somewhat Prepared 43 (52.43) Very Prepared 7 (8.5) N (%) 50 (61.0)
n	(n=85)	(n=81)	(n=85)	(n=80)	(n=82)

[+] Impossible: In the questionnaire, this response option was “Accommodating this impairment would be impossible in our organization”

Readiness to accommodate varied across company characteristics (Table 4). By percentage of respondents, the construction sector was less prepared to accommodate all impairments than other sectors, although the difference was most pronounced for mobility impairments and hearing impairments. Employers in Ontario generally reported higher readiness to accommodate impairments than those in other provinces, especially learning impairments and speech impairments. Larger companies (i.e., 50 or more workers) were more prepared to accommodate all impairments than their smaller counterparts. In adjusted models, controlling for all three conceptually relevant covariates, similar patterns emerged for sector: the construction sector was significantly less prepared to accommodate mobility impairments (AOR=0.316; p=0.047) and hearing impairments (AOR=0.202; p=0.003). In adjusted models, province was not a statistically significant predictor for readiness to accommodate across impairment types (p>0.05). Larger companies were significantly more prepared to accommodate mobility (AOR: 3.771, p=0.043) and learning (5.425, p=0.002) impairments. These findings suggest that sectoral and company size differences in readiness are robust, whereas provincial differences may be partially confounded by company size or sector.

Table 4. Descriptive statistics by impairment type and adjusted (multivariable) logistic regression models of preparedness to accommodate each impairment type from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Mobility (n=82)

Model 1	Frequency Prepared to Accommodate	Percentage	Company Characteristic (Adjusted Model)	Odds Ratio (Adjusted Model)	p-value (Adjusted Model)	95% CI (Adjusted Model)
Other Sectors	10	35.7%	Other Sectors	Ref	0.047*	0.102,0.984
Construction	8	14.8%	Construction	0.316	0.047*	0.102,0.984
Other Provinces	12	26.7%	Other Province's	Ref	0.610	0.393,4.898
Ontario	6	24.6%	Ontario	1.388	0.610	0.393,4.898
Comp. Size	N/A	N/A	Comp. Size	N/A	N/A	N/A
Less than 50	5	11.1%	Less than 50	Ref	N/A	N/A
50 or More	13	35.1%	50 or More	3.771	0.043*	1.043,13.632

Diagnostics^ (Adjusted Model)	Assumptions met /. VIF: all variables < 5. /. LRT: p= 0.030. / GOF: p=0.180

Hearing (n=78)

Model 2	Frequency Prepared to Accommodate	Percentage	Company Characteristic (Adjusted Model)	Odds Ratio (Adjusted Model)	p-value (Adjusted Model)	95% CI (Adjusted Model)
Other Sectors	19	73.1%	Other Sectors	Ref	N/A	N/A
Construction	18	34.6%	Construction	0.202	0.003	0.070,0.581
Other Provinces	16	42.1%	Other Province's	Ref	N/A	0.370,3.003
Ontario	21	52.5%	Ontario	1.054	0.100	0.393,4.898
Comp. Size	N/A	N/A	Comp. Size	N/A	N/A	N/A
Less than 50	16	38.1%	Less than 50	Ref	N/A	N/A
50 or More	21	58.3%	50 or More	2.098	0.166	0.736,5.986

Diagnostics^ (Adjusted Model)	Assumptions met / VIF: all variables < 5 /. LRT: p= 0.294 / GOF: p=0.493

Vision (n=82)

Model 3	Frequency Prepared to Accommodate	Percentage	Company Characteristic (Adjusted Model)	Odds Ratio (Adjusted Model)	p-value (Adjusted Model)	95% CI (Adjusted Model)
Other Sectors	5	18.5%	Other Sectors	Ref	N/A	N/A
Construction	7	12.7%	Construction	0.706	0.595	0.196,2.54
Other Provinces	4	9.76%	Other Province's	Ref	N/A	N/A
Ontario	8	19.5%	Ontario	1.627	0.496	0.401,6.601
Comp. Size	N/A	N/A	Comp. Size	N/A	N/A	N/A
Less than 50	4	9.1%	Less than 50	Ref	N/A	N/A
50 or More	8	21.1%	50 or More	2.163	0.278	0.536,8.724

Diagnostics^ (Adjusted Model)	Assumptions met / VIF: all variables < 5 / LRT: p= 0.258. / GOF: p=0.772

Learning (n=77)

Model 4	Frequency Prepared to Accommodate	Percentage	Company Characteristic (Adjusted Model)	Odds Ratio (Adjusted Model)	p-value (Adjusted Model)	95% CI (Adjusted Model)
Other Sectors	14	51.9%	Other Sectors	Ref	N/A	N/A
Construction	23	46.0%	Construction	0.955	0.934	0.326,2.802
Other Provinces	13	32.5%	Other Province's	Ref	N/A	N/A
Ontario	24	64.9%	Ontario	2.240	0.136	0.776,6.460
Comp. Size	N/A	N/A	Comp. Size	N/A	N/A	N/A
Less than 50	11	26.8%	Less than 50	Ref	N/A	N/A
50 or More	26	72.2%	50 or More	5.425	0.002*	1.886,15.608

Diagnostics^ (Adjusted Model)	Assumptions met / VIF: all variables < 5. / LRT: p= <0.001* / GOF: p=0.956

Speech (n=79)

Model 5	Frequency Prepared to Accommodate	Percentage	Company Characteristic (Adjusted Model)	Odds Ratio (Adjusted Model)	p-value (Adjusted Model)	95% CI (Adjusted Model)
Other Sectors	19	67.9%	Other Sectors	Ref	N/A	N/A
Construction	30	58.8%	Construction	0.735	0.560	0.261,2.069
Other Provinces	20	48.8%	Other Province's	Ref	N/A	N/A
Ontario	29	76.3%	Ontario	2.391	0.100	0.847,6.747
Comp. Size	N/A	N/A	Comp. Size	N/A	N/A	N/A
Less than 50	21	48.8%	Less than 50	Ref	N/A	N/A
50 or More	28	72.8%	50 or More	2.693	0.065*	0.938,7.727

Diagnostics^ (Adjusted Model)	Assumptions met / VIF: all variables < 5 / LRT: p= 0.007* / GOF: p=0.019

* Indicates statistically significant findings at alpha-value of p<0.05

^VIF= Variance Inflation Factor

LRT= Likelihood Ratio Test (Null Hypothesis: Restricted model of sector only fits as well as the full model.)

GOF= Hosmer-Lemeshow Goodness of Fit (Null Hypothesis: Model fits reasonably well.)

Model diagnostics indicated that multivariable models generally fit well. VIFs for all predictors in all models were less than 5. LRTs indicated that the models for hearing and vision impairments showed univariable models fit as well as the multivariable models. However, for mobility, learning and speech impairments, the LRTs demonstrated that the multivariable models accounting for province and company size fit better than the models for sector only ($p < 0.05$). This may reflect the associations between province and readiness to accommodate for both learning and speech impairments, which showed marginal associations in adjusted models. All GOF tests, except the model for speech impairment, indicated that the models fit reasonably well. Collectively, the statistical findings support the reliability of observed sectoral and company size differences in accommodation readiness.

Company respondents were presented with seven common changes intended to support or accommodate a person with disabilities and asked to report the feasibility of making each change in their organization (Table 5). Apart from providing accessible parking spaces for employees with disabilities (48.8%), fewer than 20% of companies reported that any of the potential changes were very feasible (range: 0-17.7%). Changes including allowing employees to work from home (n=51, 63.0%) and transferring people or jobs to other premises (n=23, 33.8%) were most frequently reported as impossible. Respondents rarely agreed or strongly agreed that they had flexible work procedures that allow them to hire or retain persons with disabilities in the skilled trades (n=14, 23.0%). In contrast, respondents agreed or strongly agreed that they were prepared to retain an employee who becomes disabled (n=49, 69.0%). This contrast suggests that employers may feel more confident responding to disability that emerges internally, from existing employees, rather than accommodating new hires with disabilities.

Table 5. Reported feasibility of changes for seven common workplace changes or accommodations to support persons with a disability from complete survey responses of employers of skilled trades workers, from October 2025 to January 2026.

Changes to Support or Accommodate Persons with Disabilities	Transferring people or jobs to other premises to assist disabled employees n (%)	Adapting work environment to help employees with disabilities (e.g., adapting premises, furniture, lighting) n (%)	Creating flexible work organization (e.g., transferring persons with disabilities to other jobs, rearranging work duties) n (%)	Offering flexible working time, or varying hours for employees with disabilities n (%)	Providing appropriate assistive devices/ tools/ technologies (e.g., hearing aids for someone who has a hearing impairment) n (%)	Allowing working from home for disabled employees n (%)	Providing accessible parking spaces for employees with disabilities n (%)
Feasibility of Changes at Company: **Very Feasible**	0	7 (9.0)	5 (6.3)	5 (6.2)	14 (17.7)	4 (4.9)	39 (48.8)
Feasibility of Changes at Company: **Somewhat Feasible**	14 (18.2)	21 (27.0)	22 (27.8)	24 (29.6)	29 (36.7)	12 (14.8)	27 (33.8)

Feasibility of Changes at Company: **Difficult**	20 (26.0)	12 (15.4)	17 (21.5)	21 (25.9)	15 (19.0)	2 (2.5)	2 (2.5)
Feasibility of Changes at Company: **Very Difficult**	17 (22.1)	22 (28.1)	20 (25.3)	17 (21.0)	9 (11.4)	12 (14.8)	5 (6.3)
Feasibility of Changes at Company: **Impossible**	26 (33.8)	16 (20.5)	15 (19.0)	14 (17.3)	12 (15.2)	51 (63.0)	7 (8.8)
n	77	78	79	81	79	81	80

DISCUSSION

Inequity in hiring remains a pressing issue that requires urgent, intentional action to counter workforce shortage in the skilled trades and improve outcomes for Canadians (Su et al., 2024). These findings indicate that many Canadian skilled trades employers are not prepared to accommodate various impairment types or implement common accommodations for employees with disabilities. Readiness appears to vary by impairment type, sector, and company size, and may differ by province. Information gaps and limited awareness of accommodations were common discrimination and stigma likely continue to influence hiring and accommodation decisions (Bailey et al., 2022). Notably, only 17% of respondents reported that their company did not provide equal opportunities, highlighting a disconnect between perceived and actual readiness, potentially amplified by social desirability pressures. Consistent with this concern, Boring and Delfgaauw (2024) observed substantial social desirability bias regarding diversity, equity, and inclusion policies, particularly among managers, leading firms to overstate support for equitable hiring.

Nearly three-quarters of companies reported that fewer than 1% of employees identified as a person with a disability, far below the national estimate of 13.8% among red seal workers (CAF, 2023) and estimates for apprentices in Ontario (Bishop-Williams et al., under review), or the broader employment rate for persons with disabilities (Su et al., 2024). Only 11.4% of companies reported actively recruiting for persons with disabilities, and respondents provided no examples of how such recruitment occurred. This gap suggests limited understanding of active recruitment and weal linkages to disability employment services (Ormerod and Newton, 2013). More than 80% reported rarely receiving applications from persons with disabilities. In practice, then, hiring and accommodation challenges may be infrequent not because practices are equitable, but because persons with disabilities may be deterred from entering skilled trades roles (Ormerod and Newton, 2013; Lengnick-Hall et al., 2008).

Respondents frequently requested more information, especially about available accommodations for skilled trades roles. This aligns with calls for resource inventories that provide practical strategies and assistive technologies for workplace accommodation (Du et

al., under review; Du et al., in preparation; Kaye et al., 2011). Insufficient employer information can fuel misconceptions, which were commonly reported and align with long-standing beliefs that the construction sector is not a viable pathway for youth with disabilities due to safety or training concerns (Ormerod and Newton, 2013). Misconceptions remain a persistent barrier to disability hiring (Lengnick-Hall et al., 2008; Baker et al., 2018; Kaye et al., 2011; Sepulveda, 2021). Employers most often cited functional ability, safety, and liability as barriers (Ormerod and Newton, 2013; Kaye et al., 2011). Additional information needs included clarity about productivity expectations and cost–benefit considerations (Bailey et al., 2022). The consistency of these needs across hiring, retention, and advancement implies that organizations lacking inclusive hiring practices are uncertain about how to begin engaging workers with disabilities at any stage of employment.

Accommodation readiness varied by impairment type, with particularly low readiness for vision and mobility impairments. In Canada, 26% of vision-impaired participants reported that needed accommodations were not provided (Gupta et al., 2021). Built environments often complicate accommodation and inclusive hiring (Ormerod and Newton, 2013). Although differences for vision and speech impairments were not statistically significant in this study, effect sizes suggested lower readiness in construction settings, warranting further investigation. Consistent with this, Bailey et al. (2022) identified substantial gaps in the construction literature, including lived-experience research, agency partnerships, and persistent stigma and inequity in recruitment and hiring.

Associations between readiness and province were complex and merit additional study. While differences in accessibility legislation are documented (Bishop-Williams et al., under review; Kovacs Burns and Gordon, 2009), their practical effects on employer readiness remain unclear. Company size showed mixed relationships with readiness: it significantly predicted preparedness for mobility and learning impairments but not for hearing, vision, or speech. This pattern suggests that readiness gaps may be widespread across sizes, or that other contextual factors (e.g., work organization, unionization, supply-chain pressures) play a greater role

Companies generally reported low feasibility for many common accommodations (e.g., job-site transfers, work-from-home). A scoping review of small and medium-sized enterprises identified cost, stigma, policy limits, challenges in accessing external agencies,

and legislative barriers as common obstacles (Sepulveda, 2021), aligning with our feasibility findings. Interestingly, although many employers reported that accommodating mobility impairments would be "impossible," the most feasible accommodation rated was providing accessible parking. This may indicate that structural adjustments are perceived as more feasible than process-based or operational changes. Skilled trades roles may also present unique constraints (e.g., tool/equipment dependence, safety protocols), underscoring the need to identify alternative accommodations aligned with job demands when options like remote work are infeasible.

These results have several implications. First, targeted information campaigns for skilled trades employers should directly address prevalent misconceptions and stigma and highlight evidence-based safety and productivity outcomes for workers with disabilities. Second, resources should be developed to meet employer-identified information needs (e.g., accommodation menus by impairment and task, cost/benefit examples, case studies), improving readiness while reducing perceived risk. Third, findings provide context for systemic barriers faced by workers with disabilities and can inform more meaningful supports (e.g., mentorship, job carving, modified rotations). Fourth, sector-tailored guidance can support the design of accommodation strategies that align with skilled trades environments. Finally, the study establishes a baseline to guide future interventions and to evaluate policies and practices intended to strengthen equitable integration of persons with disabilities in the skilled trades workforce. Partnerships with apprenticeship authorities and disability-serving organizations can accelerate adoption and evaluation of inclusive practices through scalable, evidence-informed tools and training across regions nationwide.

This study has limitations. Although national in reach, the survey was not available in French, likely reducing responses from Quebec and other Francophone regions. Employer-reported disability prevalence may underestimate true rates, as it reflects disclosed or visible disabilities (CAF, 2023). Nonresponse and partial response may introduce bias: although incomplete respondents did not differ statistically on observed employer characteristics, perceptions may still vary, and the characteristics of non-openers are unknown. The non-probabilistic sampling design precludes inference about representativeness and may capture more extreme views (Sedgwick, 2014).

Finally, responses may reflect social desirability bias (Grimm, 2010), leading to overestimation of equitable practices.

Future research should deepen explanation of observed patterns. Qualitative interviews or focus groups could explore employer rationales, barriers, and decision processes in greater depth. Larger samples would support disaggregation by sector, province, and company size and enable testing of interactions. Work should examine trade-specific misconceptions and barriers (Baker et al., 2018) and develop sector-tailored accommodation guidelines. Equally important, research should center the experiences of persons with disabilities in skilled trades to ensure that proposed solutions address lived realities.

CONCLUSION

Persons with disabilities continue to face inequitable employment practices across the skilled trades, rooted in insufficient information, misconceptions, and a lack of awareness of available accommodations. Sector-specific differences, especially in construction, suggest that supports should prioritize matching skills and capacity to ask demands with sector-specific constraints. Attention to provincial context and company sizes will help target implementation. Advancing equitable employment in the skilled trades can strengthen Canada's workforce and should be prioritized by employers, policymakers, and industry organizations.

Assistive Technologies for Persons with Disabilities in the Skilled Trades: A Scoping Review

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ABSTRACT

A significant global shortage of skilled workers is expected within the next decade; meanwhile, persons with disabilities are an overlooked source of talent. With the appropriate support, accommodations, and training, persons with disabilities can thrive and make valuable contributions in these critical occupations. Emerging developments of assistive technologies offer new opportunities to remove barriers for persons with disabilities to (re)enter and remain in the skilled workforce.

We conducted a scoping review to synthesize the existing research pertaining to assistive technologies designed to improve the accessibility of skilled trade occupations for persons with disabilities. Through a systematic search of seven databases and two rounds of screening, 12 relevant articles were identified.

Most articles focused on assistive technologies to support physical disabilities in the skilled trades, whereas few researched assistive technologies for cognitive or sensory disabilities. Our findings emphasize the need for employers' awareness of the assistive technologies available in order to incorporate them into their disability management strategies.

By fostering inclusive and accessible workplaces, organizations can support the (re)integration of workers with disabilities and attract new talent, thereby contributing to the growth and development of the economy.

KEYWORDS

Skilled labour, construction, manufacturing, workplace accommodations, musculoskeletal disorders.

INTRODUCTION

Disability is often mistaken for inability, but this misconception overlooks a significant untapped source of talent (Lengnick-Hall et al., 2008; T. J. Smith et al., 2023). Disability is a broad term that encompasses any impairment – physical, mental, intellectual, cognitive, learning, communication, or sensory – that, in interaction with a barrier, hinders full and equal societal participation (Government of Canada Legislative Services Branch, 2023). With the appropriate support, accommodations, and training, persons with disabilities can thrive and make valuable contributions to the workplace (Stokar & Orwat, 2018). However, persons with disabilities continue to face unemployment and underemployment.

In Canada, the employment rate of persons with disabilities (59%) is significantly lower than those without a disability (80%); of those not employed or in school, 39% (nearly 645,000 individuals) have the potential to work (Canada, 2022b). Meanwhile, there is a significant shortage of skilled trade workers, who we define as those who work within the construction, manufacturing, transportation, or service sectors. Over 700,000 skilled trade workers in Canada are expected to retire by 2028 (Employment and Social Development Canada, 2022). Ontario alone will need more than 100,000 skilled trade workers within the next decade to meet and keep pace with demands (Government of Ontario, 2023). The record-high job vacancy rates have made skilled trades businesses in Canada less competitive. Amidst these challenges, the Canadian Government has implemented financial incentives to encourage persons with disabilities to pursue a career in the skilled trades (Canada, 2022a). However, the challenges experienced by persons with disabilities go beyond financial barriers.

Several barriers prevent persons with disabilities from pursuing or even considering a career in the skilled trades. Persons with disabilities typically do not work in the trades because the work environments have not been designed or adapted to accommodate their needs (i.e., appropriate support is not provided, and tasks and functions on site are too

difficult) (Newton & Ormerod, 2005). This is often compounded by the fact that many employers perceive skilled trades as unsuitable careers for persons with disabilities due to harsh physical work environments (Houtenville & Kalargyrou, 2015; Newton & Ormerod, 2005) and the perceived complexity and cost of workplace adjustments (Churchward et al., 2017). Due to the nature of the work and the perceived and actual difficulties in matching a person's functional limitations with tasks/roles/environments within the skilled trades, employers have questioned whether a career in skilled trades is suitable for persons with disabilities (Newton & Ormerod, 2005; Winter et al., 2016).

Contrary to conventional beliefs, several countries have shown that persons with disabilities can excel in trade jobs. Task analyses revealed that workers with disabilities can perform a significant portion of trade-related tasks when given the appropriate accommodations. For instance, in an aircraft manufacturing company, workers with low-level paraplegia, workers with general paraplegia, and wheelchair users could complete 100%, 89%, 89% of the tasks analyzed, respectively (Simonelli & Camarotto, 2008). In another task analysis of bricklayers, carpenters, steel fixers, painters, and labourers, it was found that people with hearing impairments could perform all assessed activities without any adaptations, while individuals with leg or foot amputations could still perform the jobs with some adjustments (e.g., having appropriate prosthesis, or co-worker support) (Guimarães et al., 2015). Thus, working in skilled trade occupations is possible for persons with disabilities, given that organizations are open to matching persons with disabilities with appropriate tasks and accommodations for
the role.

Recent technological advancements have transformed the tools available to tradespeople and the skills and abilities needed to operate them. By leveraging technological advancements and implementing appropriate accommodations, we can unlock the full potential of this untapped workforce. Assistive technologies are equipment or technology that persons with disabilities can use to overcome or minimize barriers at the workplace and effectively perform various work tasks (Padkapayeva et al., 2017). Hence, assistive technologies can empower persons with disabilities to perform essential tasks and reduce the need for role reallocation. Assistive technologies also offer new opportunities for persons

with disabilities to (re)enter and remain in the workplace as a skilled trades worker. Given that the lack of suitable alternative work is the top reason workers with disabilities do not return to the workplace (Winter et al., 2016), examining the emergence and potential applications of assistive technologies can provide valuable insights into innovations that can enhance participation in skilled trades.

In this review, we aim to systematically synthesize the existing literature on assistive technology that facilitates the inclusion of persons with disabilities in skilled trades occupations. The following research question was formulated: What assistive tools and technologies have been studied to improve inclusivity and accessibility in skilled trade occupations for people with disabilities?

METHODS

To address our research question, we conducted a scoping review. Scoping reviews are particularly useful for understanding the breadth and nature of the research conducted about a topic, summarizing findings from a heterogeneous body of knowledge in methods, and identifying gaps within the existing literature. Scoping reviews adopt a robust and systematic approach to the search strategy, the identification of relevant articles, and the data extraction and charting of research (Munn et al., 2018; Tricco et al., 2018). Our scoping review adopted the methodology and best practices set out by the PRISMA Extension for Scoping Reviews (Tricco et al., 2018).

Systematic Search Strategy

We systematically searched seven databases for original peer-reviewed articles pertaining to assistive technologies aimed at making skilled trade occupations more inclusive and accessible for people with disabilities. The databases used included PubMed, Scopus, PsycINFO, Web of Science, Embase, ProQuest, and Sociological Abstracts. These databases were selected due to their comprehensive coverage of topics related to disability accommodation.

We adopted the PICO (population, intervention, comparison, outcome) model to guide the development of the search terms. Although we did not limit the search to a specific comparison group, we specified that the context in which persons with disabilities would be

working or pursuing work in. Thus, search terms were developed around four key concepts: 1) persons with disabilities, 2) skilled trade occupations, 3) workplace accommodations, and 4) outcomes related to employment (Table 1). Where applicable, subject headers (e.g., MeSH terms, EmTrees) for each of the databases were also identified. Boolean operators “OR” and “AND” were used between search terms within a concept and across concepts, respectively. The formal search was conducted on November 27, 2023, and yielded a total of 2715 results after removing duplicates.

Table 1. Search terms.

Population (Persons with Disabilities)	disabilit* OR impair* OR handicap* OR disabl* OR neurodiver*
Intervention (Workplace accommodations for people with disability)	intervention* OR program* OR policy OR policies OR procedure OR procedures OR practice OR practices OR management OR stay-at-work OR "stay at work" OR return-to-work OR "return to work" OR accommodat* OR "work* adaptation" OR training OR "work* socialization" OR "job coaching" OR "peer support" OR "modified duty" OR "modified duties" OR "modified jobs" OR "modified job" OR "modified work" OR "assistive device" OR "assistive devices" OR "assistive technolog*" OR "technical aids" OR "technical aid" OR "technical aides" OR " equipment adjustment*" OR "equipment modification*" OR "flexible hour*" OR "flexible shift*" OR "flexible schedule*" OR "job placement*" OR "work* placement" OR "engineering design*" OR "built environment"
Context (Skilled Trades)	"skilled trade*" OR "industrial work*" OR "industrial jobs" OR "industrial sector*" OR "automotive work*" OR "automotive jobs" OR "automotive sector*" OR "automotive industr*" OR "construction work*" OR "construction jobs" OR "construction sector*" OR "construction industr*" OR "manufacturing sector*" OR "manufacturing industr*" OR "service sector*" OR hospitality OR "food processing industry*" OR "food industr*" OR "food service*" OR “Agricultural Equipment Technician*” OR “Appliance Service Technician*” OR “Auto Body and Collision Technician*” OR “Automotive Refinishing Technician*” OR “Automotive Service Technician*” OR “Baker” OR “Bakers” Or “Boilermaker*” OR “Bricklayer*” OR “Cabinetmaker*” OR “Carpenter*” OR “Concrete Finisher*” OR “Construction Craft Worker*” OR “Electrician*” OR Cook OR Cooks OR “Drywall Finisher*” OR “Plasterer*” OR “Floorcovering Installer*” OR “Gasfitter*” OR Glazier* OR Hairstylist* OR “Heavy Duty Equipment Technician*” OR “Heavy Equipment Operator*” OR “Millwright*” OR “Industrial Mechanic*” OR “Instrumentation and Control Technician*” OR “Insulator*” OR Ironworker* OR Horticulturist* OR Lather* OR “Interior Systems Mechanic*” OR Machinist* OR “Metal Fabricator*” OR “Fitter*” OR “Crane Operator*” OR “Motorcycle Technician*” OR “Oil Heat System Technician*” OR Painter* OR Decorator* OR “Parts Technician*” OR Plumber* OR “Powerline Technician*” OR “Recreation Vehicle Service Technician*” OR “Refrigeration and Air Conditioning Mechanic*” OR Roofer* OR “Sheet Metal Worker*” OR Steamfitter* OR Pipefitter* OR Tilesetter* OR “Tool and Die Maker*” OR “Transport Trailer Technician*” OR “Truck and Transport Mechanic*” OR “Welder*”
Outcomes of Interest (Employment)	diversity OR diverse OR equity OR "job status" OR jobstatus OR inclusion OR inclusiv* OR employ* OR work* OR occupation* OR participat* OR retention OR retaining OR recruitment OR recruiting OR hiring OR hire OR hires OR attracting OR attract OR reintegrat* OR integrat* OR earning* OR accessib*

Relevant Study Selection

Original peer-reviewed research articles written in English that identified or assessed assistive technologies for persons with disabilities in the skilled trades were selected and retained. Assistive technologies were defined as “any item, piece of equipment, software

program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities" (Assistive Technology Industry Association, 2015). We included case studies, case reports, needs assessments, and experimental studies. Articles were excluded for the following reasons: a) published before 2000, b) non-original peer-reviewed journal article (e.g., review articles, editorials), c) not related to skilled trades occupations, d) not related to people with existing disability (e.g., primary prevention intervention), e) not related to an assistive technologies (e.g., flexible work schedules, work reallocation, organizational policies).

Relevant studies were selected over two rounds of screening: a preliminary title and abstract screen and a full-text review. Both phases were completed using the Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia) and a screening tool that was developed a priori.

During the title and abstract screening, four reviewers independently reviewed the titles and abstracts of each article by selecting "Yes," "No," or "Maybe" to their relevance for inclusion. Two reviewers screened each title and abstract. An article proceeded to full-text review if it received two "yes" votes, two "maybe" votes, or a "yes" and a "maybe" vote. Any discrepancies between reviewers (i.e., one "yes" and one "no" vote, or one "maybe" and one "no" vote) for inclusion of an article were discussed by the reviewers until consensus was reached; the article was retained for full-text review when consensus could not be reached. Four hundred forty-seven studies advanced to full-text review.

The full-text review was completed independently by three researchers, with each article reviewed by at least two of the researchers. Articles were included for data extraction if the two reviewers agreed. If an article was excluded, the reason for exclusion was recorded. Similar to the preliminary title and abstract screening, any discrepancies between reviewers of an article were discussed among the coauthors until a consensus was reached. Twelve articles were retained for data extraction (Figure 1).

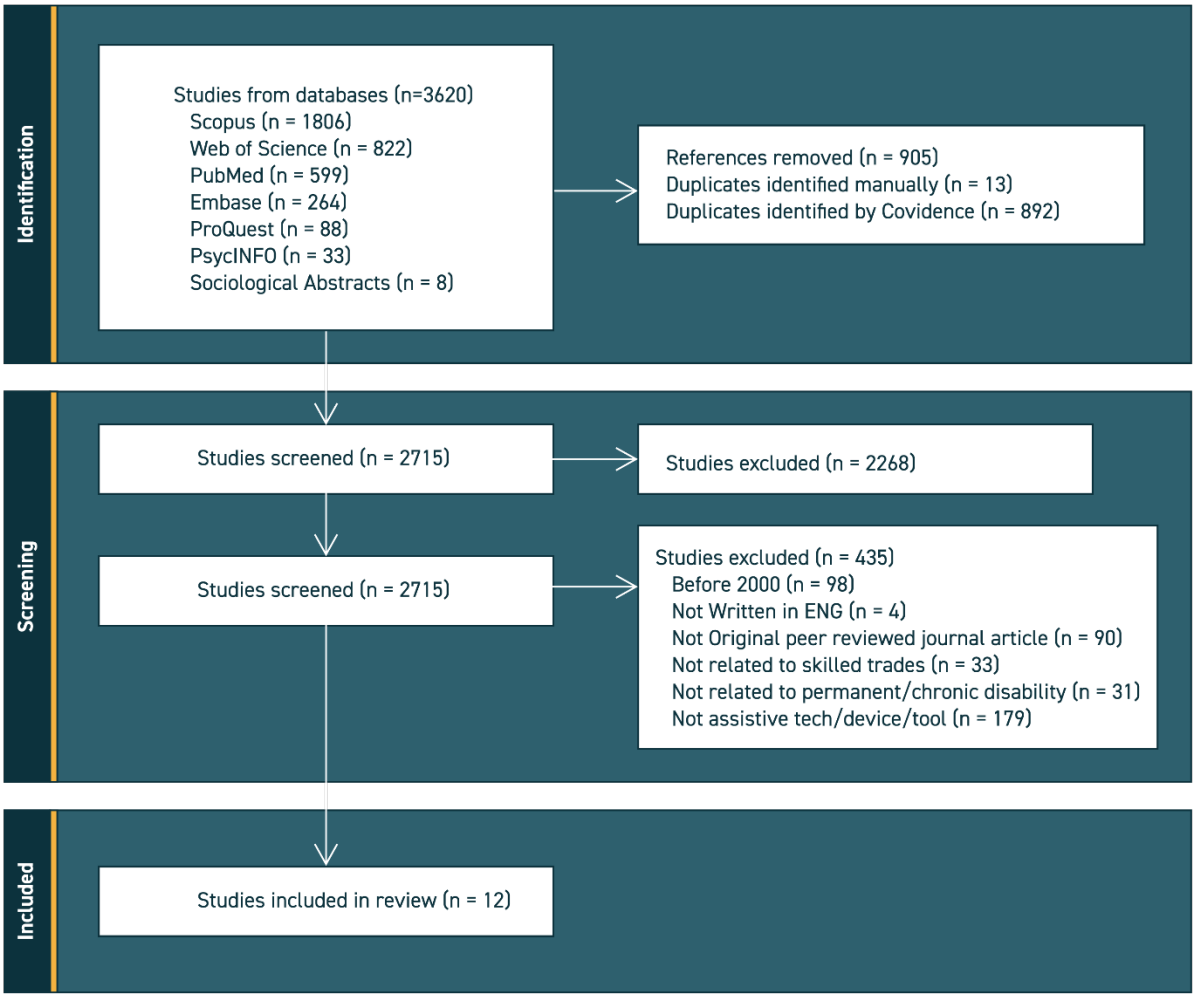

Figure 1. PRISMA flow diagram of the process to retrieve relevant articles.

Data Extraction

Two co-authors independently extracted relevant study characteristics (e.g., lead author, year of publication, country where the study was conducted, study objective, study design, and study sample) and key findings from each article. To facilitate interpretation while accommodating the heterogeneous nature of the research methodologies, the articles were organized based on the disability type(s) that the assistive technology assisted.

RESULTS

We identified 12 peer-reviewed articles that described, identified, or evaluated assistive technologies for tradespersons with disabilities (Table 2). Overall, most of the assistive technologies were designed to support physical disabilities such as low back pain, paralysis, loss of limb, and musculoskeletal disorders in general. Research in this area was conducted in Spain (n=3), Brazil (n=2), the United States (n=2), Finland (n=1), Iran (n=1), New Zealand (n=1), Germany (n=1) and India(n=1).

One study described software that converts engineering information drawings into Braille for visually impaired CNC operators. Two studies trialed various combinations of assistive technologies and work designs to make production work more accessible to people with a diverse range of disabilities, including cognitive, learning, and developmental disabilities. Most of the interventions identified were tested or designed for industrial and manufacturing workers, such as CNC operators, truck drivers, meat cutters, and assembly workers.

Table 2. Summary of studies pertaining to assistive technologies to make skilled trade occupations more inclusive and accessible for people with disabilities.

Physical (eg, mobility, flexibility, and dexterity, and pain-related disabilities)

Lead author (year), country	Aim of study	Study design	Intervention *(Int)*/ Control *(Ctrl)*	Study Sample
Husing (2021), Germany	Introduce a new approach of better match level of assistance from collaborative robots for various levels of capabilities	Methods paper	*Int:* Human-robot collaboration software that considers human capabilities and process requirements to determine the level of support or assistance of a collaborative robot.	1 simulation of an assembly worker in a wheelchair performing the "form-fit positioning" task.
Bataller-Cervero (2019), Spain	Evaluate the effectiveness of a lumbar support on back functionality and disability in assembly-line workers who have low back pain.	Randomized controlled trial (2-months)	*Int:* Back support (Activemov Lombalift, BSN medical) *Ctrl:* Kinesiotape on the lower back without any stress	28 assembly-line workers with low back pain of two plants of the same electrical appliances manufacturing company.
Rannisto (2019), Finland	Evaluate the effect of insoles with leg-length discrepancy correction among meat cutters with leg-length discrepancy.	Randomized controlled trial (1 year)	*Int:* Leg-length discrepancy corrected insoles (JalasFX2 insoles) *Ctrl:* Insoles (JalasFX2 insoles)	42 meat cutters with leg-length discrepancy and low back pain who were over 35 years old and had > 10 years of tenure (20 int; 22 ctrl)
Kim (2018), United States	Evaluate the ability of two seating interventions to attenuate whole-body vibration exposures and improve health outcomes for truck drivers with low back pain.	Randomized controlled trial (1 year)	*Int:* Active vibration-cancelling seats *Ctrl:* Air ride seat (passive suspension)	40 truck drivers with low back pain (16 interventions; 17 controls after dropout)
Guimarães (2015), Brazil	Evaluate jobs on a construction site to determine the profile of workers with disabilities who could perform these jobs and what adaptations are needed.	Mixed methods	*Int*: Fingers, thumb, hand, arm, leg, and foot prosthetics	Task analysis: 1 bricklayer, 1 carpenter, 1 steel fixer, 1 painter, 2 labourers and 1 foreman on the construction site of a water supply network. Simulated personas: a person with total hearing impairments, total and partial visual impairments, amputations of the fingers, the thumb, a hand, an arm, a leg and a foot.

Rezazadeh (2011), Iran	Evaluate a novel facial multichannel bioelectric-signals processing approach that extracts affective measures to facilitate control commands in a crane operation simulation	Crossover study	*Int:* Virtual crane training system controlled using facial gestures and updated using effective measures *Ctrl:* Virtual crane training system controlled using facial gestures	10 healthy male students aged 23 ± 2 years; participants did not have disabilities.
Dean (2011), New Zealand	Explore and document the experiences of New Zealand farmers who continue to work despite their low back pain	Mixed methods	*Participant identified int.*: upright shearing platforms; shearing harnesses; improved ATV seating and design; animal conveyor systems, new baling gear.	33 farmers with recent episode of non-specific low back pain and continued working.
Simonelli (2008), Brazil	Systematize tasks at a Brazilian aircraft manufacturing plant to identify industrial tasks that can potentially be performed by persons with disabilities	Observations	*Int:* Appropriate prostheses for upper and lower-limb amputees	Task analysis: 19 workstations at a Brazilian aircraft manufacturer Simulated personas: persona with low-level paraplegia, general paraplegia, low-level tetraplegia, impaired hearing, hemiplegia, upper limb amputee with appropriate prostheses, lower-limb amputee with appropriate prosthesis, wheelchair user with intact upper limbs.
Oleske (2007), United States	Evaluate the effectiveness of a back support on promoting recovery from a work-related low back disorder.	Randomized controlled trial (1-year)	*Int:* Back support belt (Ergodyne Proflex) + Education *Ctrl:* Education alone	433 employed hourly union workers from 3 automotive divisions who had a recent diagnosis of a work-related low back pain (222 int; 211 ctrl)

Sensory (Vision or seeing disability)

Lead author (year), country	Aim of study	Study design	Intervention *(Int)*/ Control *(Ctrl)*	Study Sample
Ramteke (2014), India	Describe a method to covert engineering drawings information into Braille.	Methods paper	*Int*: A method to convert engineering drawings into Braille	Braille output have not yet been tested on visually impaired machine operators
Simoes (2021), Spain (Multiple Disabilities)	Describe and evaluate an immersive and interactive training system for workers with impairments by reducing the mental resources required to complete a task.	Non-randomized control trial	*Int*: Cross Reality (XR) prototype *Ctrl*: Continuous support from a supervisor who answered participants' questions during the task.	20 electrical panel assembly workers (10 women, 10 men; 4 with cognitive impairments, 4 with physical disabilities, and 2 with a sensory impairment
Miralles (2011), Spain (Multiple Disabilities)	Describe the Poka-Yoke approach and evaluate its impact in a sheltered work centre for the disabled.	Pre-post study	*Int*: The Poka-Yoke approach, a universal design approach that uses devices on process equipment to prevent errors and enhance quality and overall output.	12 employees with various disabilities at a sheltered work centre for the disabled.

ASSISTIVE TECHNOLOGIES FOR PHYSICAL DISABILITIES

Assistive Technologies For Low Back Pain

Most articles regarding physical disability studied assistive technologies aimed at enabling existing workers with low back pain (LBP) to continue work by reducing LBP-related exposures and symptoms. Four of the five studies used randomized controlled trials to evaluate the assistive technologies; the remaining study adopted a retrospective approach to identify interventions already used by farmers with LBP. Of the randomized controlled trials, two investigated back supports for manufacturing workers experiencing LBP. Although limited evidence supports the use of back supports as a tool for primary prevention, the authors explored whether back supports could be effective as a secondary prevention device used to promote recovery and prevent recurrence (Bataller-Cervero et al., 2019; Oleske et al., 2007). Oleske et al. (2007) compared the outcomes between a group that received both a back support and a back education program versus a control group that received only the back education program. Bataller-Cervero et al. (2019), on the other hand, compared the use of back support with a control group that received two strips of Kinesiology tape applied without any tension on the paraspinal muscles. Both studies found no differences between the intervention and control groups and concluded that back supports were generally ineffective to promoting recovery and preventing recurrence. Two other types of LBP-related assistive technologies were evaluated, via randomized controlled trials, for their effectiveness in promoting recovery and preventing recurrence. Kim et al. (2018) investigated the differences in LBP and other health outcomes between two seating interventions aimed at reducing whole-body vibration, a risk factor for LBP. The seat technology evaluated was an industry-standard air-suspension seat versus an active suspension seat. Measurements of regional body pain, low back disability, physical and mental health, and work limitation were collected before the intervention and 3 and 6 months after implementation of the seats. Although both interventions significantly reduced whole-body vibration exposures, the active suspension had a more significant vibration reduction. Kim et al. (2018) also found that the group using the active suspension seat experienced significant improvements in all health and work outcomes, including decreased LBP and work limitation, while the group using the air suspension seat showed no statistically significant improvements

in those measures (Kim et al., 2018). Rannisto et al. (2019) evaluated the effect of insoles that corrected leg-length discrepancy among meat cutters. Compared to those who wore regular insoles, participants who wore the leg-length discrepancy correction insoles experienced significantly more improvements in self-reported measures of LBP intensity, sciatic pain, physical functioning, and likelihood of sick leaves compared to participants who wore regular insoles (Rannisto et al., 2019). Unlike the back supports, both Kim et al. (2018) and Rannisto et al. (2019) found that the studied assistive technologies were beneficial for individuals with pre-existing LBP.

One retrospective study interviewed the farmers with LBP about their mindset and strategies for continuing to work despite having LBP. The farmers shared that they had to "re-think" their approach to work. They noted the tasks that aggravated their LBP and identified ways to modify their tasks or equipment. Some assistive technologies identified included animal conveyor systems, new bailing gear, upright shearing platforms, and improved ATV seating designs. Although farmers with lived experiences identified these assistive technologies, they have not been evaluated for generalizability to other farmers with LBP.

Software-Related Assistive Technologies

Two studies explored the feasibility of novel computer models to enable persons with physical disability to work. Husing et al. (2021) described a method to adjust the level of assistance provided by a collaborative robot to match the capabilities of a person with a disability. The method considers both human capabilities (e.g., exerting force, working with both hands) and the task requirements of an industrial job. In a case example, the authors illustrated how this approach was successfully used to accommodate a wheelchair user in completing a form-fitting task (Hüsing et al., 2021). Rezazadeh et al. (2011) evaluated a method that utilized an individual's facial expressions to virtually control heavy-duty equipment. The method enhances the accuracy and sensitivity of the commands and controls by updating the program in real-time using the users' bioelectric signals (i.e., cognitive load and level of satisfaction). Results from laboratory testing found that the method accurately differentiated between facial expressions and could be used over long periods and in different job sites. The authors

suggested that the method would be particularly useful to people who are paralyzed below the neck (Rezazadeh et al., 2011).

Use of Prosthetics

Two studies assessed the physical, mental, and sensory demands of various jobs and tasks to identify tasks and jobs that persons with disabilities can perform. Through simulated work scenarios and personas, the studies evaluated the feasibility of persons with disabilities working in those occupations. Simulated personas included people with a loss of limb who used prosthetics. Both studies were conducted in Brazil, one on a construction site and the other on an aircraft manufacturing plant (Guimarães et al., 2015; Simonelli & Camarotto, 2008). De Guimaraes et al. (2015) found that the use of appropriate prostheses for the leg or foot, as opposed to crutches, would enable workers to move around the construction site and handle tools while moving and standing. As a result, they could perform all tasks of the bricklayer, carpenter, steel fixer, painter, labourer, and foreman. Similarly, Simonelli et al. (2008) assessed 19 workstations within an aircraft manufacturing plant and found that 68% of the work could be filled by workers with loss of upper limb, given that they had adequate prostheses.

Assistive Technologies for Visual Impairments

One study described and pilot tested a parser software for converting engineering drawings into voice or Braille for blind machine operators (Ramteke et al., 2014). The software extracts design features from engineering information drawings in neutral CAD (computer-aided design) formats and converts it into a text description, which can be converted into Braille (i.e., BRF files) or voice. Application of the software for a simple 2D drawing was successful in extracting the start and end point of coordinates of lines, establishing connectivity between points, and correctly determining the length and orientation of each line. The text output from the parser was also successfully converted to voice and Braille. Despite its success, further development is needed before the parser software can be implemented in practice for more complex engineering drawings.

Assistive Technologies Supporting Multiple Disability Types

Two studies described and evaluated approaches to utilizing assistive technologies to simplify various assembly tasks and work processes (Miralles et al., 2011; Simões et al., 2021). One was a cross-reality (XR) training system prototype, and the other was Poka Yoke, a universal design approach that uses simple devices, such as sorting boards, on process equipment to prevent errors and enhance quality and overall output. Both approaches aimed to reduce the mental demands of a task, reduce errors, and enhance output quality for all workers.

The XR training system used projectors and step-by-step voice commands to guide workers through the procedures of a wiring task (Simões et al., 2021). With the aid of the XR training system, workers with disabilities (physical, sensory, cognitive, and learning) were able to complete tasks that they typically couldn't complete. Participants who used the XR training system took less time to complete the task than those who did not. In fact, without the assistance of the XR training system, many participants were unable to complete the task.

The Poka-Yoke approach was piloted in five workstations of a sheltered work centre for persons with disabilities that assembles and packages electrical/electronic devices and metal/plastic products for furniture (Miralles et al., 2011). At the time of the study, twelve of twenty workers had difficulties with one or several of the five workstations. Considering the five workstations and twelve workers, 61.7% of person-to-task assignments were incompatible. Following the implementation of the Poka-Yoke approach, there was a 35% increase in possible person-to-task assignments. As an example of how an assistive technology was used to modify a task, a counting board was used to ensure the correct number of screws was included in the package. Both the XR training system and the Poka-Yoke approach can be implemented to benefit all workers, however, they particularly benefit those with mental disabilities. A summary of the research findings is presented in Table 3.

Table 1. Key findings and outcomes of assistive technologies studied.

Lead author (year)	Intervention	Disability Type	Health and Wellness (Findings and Outcomes)	Productivity and Performance & Feasibility and Uptake (Findings and Outcomes)
Bataller-Cervero (2019)	Back support belt (Activemov Lombalift, BSN medical)	Low back pain	No change in maximum flexion angle, elongation and flexion velocity and F/R ratios for right and left longissimus and multifidus of the Flexion-Relaxation, lumbar normality index, collaboration index, sit-to-stand normality index, and lifting a weight index. No improvement in lumbar functionality and disability for assembly-line workers with previous episodes of sick leave by low back pain when wearing a flexible lumbar support.	N/A
Oleske (2007)	Back support belt (Ergodyne Proflex)	Low back pain	↓ lower back pain disability and neurogenic symptoms in both study groups ↑ improved physical health in both study groups No impact of back supports plus health education on mental or physical health, low back pain, back pain disability, neurogenic symptoms, the likelihood of recurrence of an episode or other administrative measures of healthcare utilization.	Use of a back support with health education may aid in reducing the likelihood of a recurrent work-related low back disorder in industrial workers in parts distribution centers. (Feasibility and Uptake)

Kim (2018)	Active vibration-cancelling seats	Low back pain	>25% ⇣ low back pain ⇣ other musculoskeletal outcomes ↑ group's physical health after intervention while control group experienced no improvements (SF-12 scores)	⇣ work limitation in the intervention group over time whereas the control group showed inconsistent changes. (Productivity and Performance) ~50% ↓ WBV exposure reduction in the intervention group and ~26% ↓ in the control group. No change in the impulsive exposures post-intervention and between groups. (Feasibility and Uptake)
Rannisto (2019)	Leg-length discrepancy corrected insoles (JalasFX2 insoles)	Low back pain	↓ low back pain intensity (− 2.6; 95% C.I. −3.7 to − 1.4), ↓ sciatic pain intensity (− 2.3; − 3.4 to − 1.07) ↑ physical functioning (9.6; 1.6–17.6) (RAND-36) ↓ likelihood of sick leaves (OR -3.7; -7.2 to -0.2)	Effective intervention among workers with low back pain and a standing job. (Feasibility and Uptake)
Dean (2011)	Upright shearing platforms; shearing harnesses; improved seating and design of ATVs; animal conveyor systems, new baling gear	Low back pain	N/A	Participants were able to continue work by modifying their work activities through new technologies. (Productivity and Performance) Interventions are already used by participants to remain at work. (Feasibility and Uptake)
Husing (2021)	Software that customizes the level of support or assistance from a collaborative robot based on human capabilities and	Musculoskeletal disorder	N/A	Assessing the demands of each task and the capabilities of an individual will allow programmers to adjust the level of assistance provided by the collaborative robot to match the capabilities of the individual.

	process requirements			
Guimarães (2015)	Finger, thumb, hand, arm, leg, and foot prosthetics	Loss of limb	N/A	Climbing scaffolding poses a serious and imminent risk to those with amputated fingers using fixed prosthetics (i.e., tasks of the labourer, bricklayer, carpenter and steel fixed) Use of leg or foot prosthetic would allow work to be carried out in all jobs evaluated
Simonelli (2008)	Upper and lower limb prosthetics	Lost of limb	N/A	68% of the 19 workstations can be completed by upper-limb amputees wearing adequate prostheses; 100% by lower-limb amputees wearing adequate prostheses
Rezazadeh (2011)	Virtual crane training system controlled using facial gestures and updated using effective measures	Quadriplegia	N/A	Users were more satisfied with the affective interface compared to traditional interface. Usable over a long-running period, different operation sites, and different levels of difficulty with high-performance measures.
Ramteke (2014)	Process to convert engineering drawings into Braille	Visually impaired	N/A	Successfully converted engineering drawings into Braille. Some limitations exist before implementation.
Miralles (2011)	Poka-Yoke universal design approach	Physical; Intellectual; Cognitive; Mental	36% increase in task completion among 12 workers after redesigning 5 workstations using Poka Yoke.	Application of Poka-Yoke offered benefits to all workers, not just those with disabilities.
Simoes (2021)	Cross Reality (XR) prototype	Physical; Sensory; Cognitive; Learning	Significant productivity gains	High adoption by participants, validating the suitability of the solution for workers in industrial manufacturing processes.

↑↓ Significant increase or decrease; ↑̇↓̇ Non-significant increase or decrease

DISCUSSION

Assistive technologies are critical in making skilled trade jobs and tasks accessible to persons with disabilities, thus potentially mitigating the skills shortage. In this scoping review, we identified 13 unique assistive technologies designed for used by skilled trade workers across 12 articles. Active vibration-cancelling truck seats allowed workers with LBP to work regular hours and reduced the intensity of self-reported lower back pain (Kim et al., 2018). The Poka-Yoke approach and an XR training system supported sheltered workers with mental disabilities in completing tasks they previously found challenging or impossible (Miralles et al., 2011; Simões et al., 2021). Technological advancements using facial and affective inputs to control a virtual crane may one day allow quadriplegics to operate heavy-duty equipment virtually (Rezazadeh et al., 2011). Research has also been done to develop processes and software for converting engineering drawings into Braille to allow the visually impaired to independently operate CNC machines (Ramteke et al., 2014). There is also software to program collaborative robots to match the level of support provided with the abilities of persons with disabilities (Hüsing et al., 2021). Much of the identified assistive technologies-related research was conducted within the past 15 years and focused on workers with physical disabilities within the industrial and manufacturing sectors.

Assistive technologies will play a significant role within organizational work disability management programs/systems in making skilled trades more accessible. Assistive technologies have the potential to provide persons with disabilities a sense of independence at work by reducing their reliance on others (Simões et al., 2021). Assistive technologies also support persons with disabilities to work as tradespeople (where the skills shortage exists), as opposed to being assigned other work within the sector. Given their benefits, we must also acknowledge their limitations as an accommodation strategy. Assistive technologies is only one type of accommodation strategy within the disability management toolbox and should be considered alongside other strategies. For example, most of the assistive technologies identified in our study were for people with physical-related disabilities. Alternative accommodations may be necessary for people with sensory or mental disabilities, such as a

sign interpreter, supervisor support, modified duties/hours/locations, and adjustments to the built environment (e.g., lighting, noise level). We must also acknowledge the reality that some disabilities are unsuitable or unsafe for some skilled trades and work environments. For example, visual disabilities would pose significant challenges on the construction site, as vision is essential for performing tasks, navigating the work site, and avoiding safety hazards.

Despite the advancements and research, there remains a need for more intervention studies to assess the impact and feasibility of assistive technologies in the workplace. Findings may facilitate design improvements and support employers' decisions for adoption (E. M. Smith et al., 2025). This is important because not all assistive technologies work as intended in practice. For example, two studies found that back belts did not positively impact manufacturing workers with LBP (Bataller-Cervero et al., 2019; Oleske et al., 2007). To our knowledge, there is an abundance of commercially available assistive technologies for the skilled trades that have yet to be evaluated. The Job Accommodations Network lists over 145 items that aim to improve workers' capacity for working in the construction sector alone (Job Accommodation Network, n.d.). The lack of awareness of assistive technologies available for skilled trade-related tasks and the complexities of participant selection and recruitment may be overarching barriers for research in this area.

A lack of awareness in the assistive technologies available for skilled trade-related tasks exists, and there is a misconception that assistive technologies need to be expensive and high-tech custom-made devices (Padkapayeva et al., 2017). However, the assistive technologies listed in the Job Accommodations Network are often commercially available devices that are not advertised as assistive technologies for persons with disabilities. Examples of assistive technologies for construction workers with disabilities can be as simple as adjustable drafting tables, extra grip gloves, or leg-foot gas pedals. Similarly, in their evidence synthesis of accommodations for people with physical disabilities, Padkapayeva et al. (2017) found that assistive technologies include not only high-tech, but also low-tech equipment or tools as simple as hooks, gloves, or change dispensers. Assistive technologies for workers with mild functional limitations usually involve providing low-cost, commercially available products. Although anyone can use these assistive technologies to make the skilled trades tasks more inclusive and accessible, our scoping review found that they have not been

documented in the literature through the lens of work integration for people with disabilities. Documenting the implementation of simple and inexpensive assistive technologies can help employers explore potential accommodations that may reduce employment barriers for persons with disabilities. Best practice suggests adopting a case-by-case approach to determine reasonable accommodations for each worker with a disability (CSA Group, 2024). Hence, the selection and recruitment of appropriate study participants who may benefit from the use of an assistive technology is logistically difficult. For the retained articles, we note that researchers mainly focused on assistive technologies that support common work disabilities, such as LBP; conversely, we note the lack of research on assistive technologies for people with mental disabilities, potentially due to unique individual differences. In fact, most (~42%) of the retained articles investigated assistive technologies for people with LBP, which makes sense because LBP is a prevalent work disability and shares similar work limitations (e.g., bending, twisting, lifting) (Rosenblum & Ruth, 2023). Further, most of the retained studies were conducted in the industrial and manufacturing sectors (i.e., truck driving or assembly line work), which are more controlled environments than the construction sector. In fact, only one study was conducted on a construction site (De Guimaraes, 2015). Additional articles related to the use of assistive technologies in the construction sector were not identified since De Guimaraes et al. (2015) intimated the "lack of literature on the topic of the workplace accommodation of people with disabilities in the construction industry". The combination of obtaining the appropriate sample, assistive technology, and study setting is a challenge for intervention studies to evaluate their impacts and feasibility in practice.

Recommendations for Future Studies

To guide future studies, it is worth reflecting on the past successes of the retained articles aimed at advancing our understanding of assistive technologies to make the skilled trades more accessible for persons with disabilities.

1. Taking a retrospective approach: While intervention studies (e.g., prospective studies, randomized controlled trials, controlled trials, crossover studies) are important for understanding the generalizability and effectiveness of an assistive technology, they face challenges with the application of one AT for a homogenous study sample (mentioned above). As an alternative approach, Dean et al. (2011) identified farmers with low back

pain and interviewed them about their strategies to remain productive on the farm. This approach identified and synthesized several effective assistive technologies and strategies already in use that make farming accessible for farmers with low back pain.

2. Collaborating with sheltered work and training centers to pilot and evaluate innovations: Sheltered work and training centers employ equity-deserving populations such as persons with disabilities. Miralles et al. (2011), Ramteke et al. (2014), and Simoes et al. (2021) recruited their participants in this type of organization to find a more homogenous sample to evaluate an assistive technology.

Additionally, it is important that employers or workers are aware of interventions available for accommodation. We believe that compiling a database of case studies that provide trade-specific examples of how people with disabilities were accommodated. Websites such as the Job Accommodations Network and REHADAT Assistive Products (REHADAT, n.d.) have an inventory of case studies on how assistive technologies were implemented. Case studies are useful in communicating the real-life context in which assistive technologies have been implemented (Crowe et al., 2011). However, they should be interpreted with caution if lacking scientific rigour and if there is little basis for generalization.

Limitations

This review is not without limitations. Our focus on assistive technologies excluded personal protective equipment, such as masks for individuals with asthma or immunodeficiencies and hearing protection for the hearing impaired, and other forms of accommodation that do not fall under our definition of assistive technologies . The scope of our review also excluded fundamental devices needed for an ergonomic work environment (e.g., adjustable seats and tables for appropriate seating posture, environmental brightness and contrast regulation for visual comfort, etc.). Consequently, our findings may not fully capture the diverse range of tools and strategies available to support accessibility in the skilled trades. However, we ensured a robust selection process by having at least two independent reviewers screen each paper. We also retained assistive technologies for all disability types and organized them by disability type. This is an important step as disability

research has often grouped people with disabilities together, assuming one homogenous group. This review focused on the unique assistive technologies for various disability types.

CONCLUSION

This scoping review underscores the importance and need for research on assistive technologies to make skilled trade occupations more accessible for persons with disabilities. The literature reveals a variety of assistive technologies, such as active vibration-cancelling seats and software converting engineering drawings into Braille, that accommodate physical, sensory, and cognitive disabilities. Despite these advancements, further research is needed to evaluate the practical impacts of assistive technologies in real-world settings. Employers must be aware of the effectiveness of assistive technologies and consider its implementation as part of a comprehensive disability management strategy. The findings highlight the necessity of a case-by-case approach to accommodate the unique needs of individuals with disabilities, while also recognizing the broader benefits of universal design principles. Future research should focus on overcoming barriers to assistive technologies adoption, including cost concerns and lack of awareness, to fully leverage the potential of assistive technologies in reducing the skills shortage in the skilled trades. By fostering an inclusive workplace, organizations can support the work reintegration of those with acquired disabilities and attract new talent, contributing to the growth and development of the Canadian economy and infrastructure.

Workplace Support Solutions for Persons with Disabilities in Skilled Trades: A Systematic Environmental Scan

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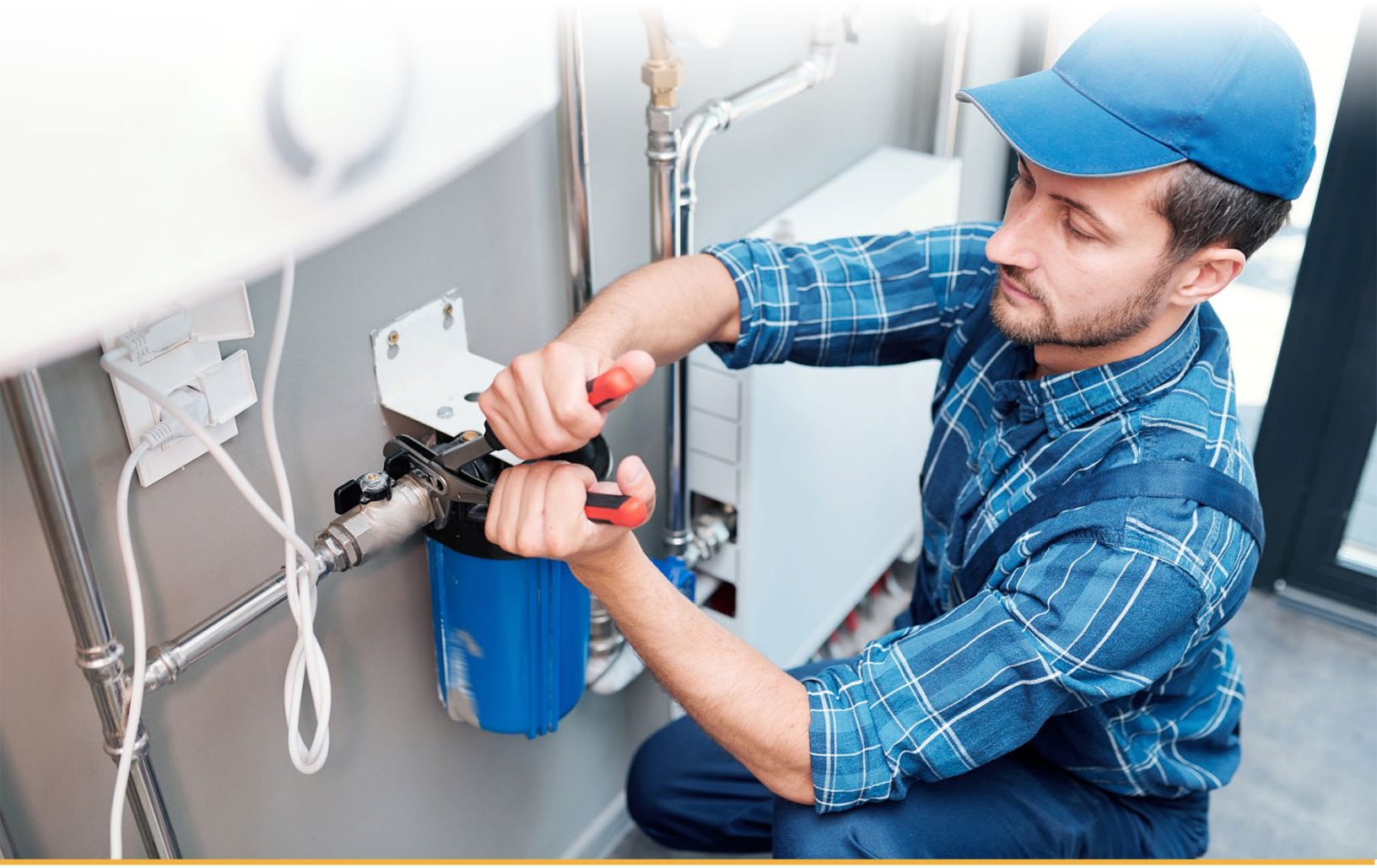

ABSTRACT

Skilled trades are a critical sector for Canada's economy and ongoing reductions in this workforce present potential instability for future global competitiveness. Persons with disabilities represent a substantial untapped workforce that could help address these shortages when provided with relevant and appropriate workplace support solutions.

A systematic environmental scan of a popular search engine was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. The first 100 links of each search were reviewed for potential eligibility, and relevant links were assessed in detail for information related to workplace solutions, including assistive products, supportive devices, and job accommodations for various impairments in skilled trades sectors. Data were extracted and synthesized according to impairment type and trade-specific applications.

In total, 242 relevant internet sources were identified, describing 124 unique support solutions. Identified solutions primarily supported physical impairments (n=81, 65.3%), followed by vision (n=26, 21.0%), hearing (n=10, 8.1%), and learning, cognitive, memory, or mental health-related (n=7, 5.6%) impairments

This environmental scan identified that workplace support solutions for skilled trades workers are disproportionately distributed across impairment types: limited supports were identified for vision, hearing, or cognitive impairments compared to physical impairments. More information related to the job-specific tasks and demands of trades work, and the development of solutions that directly address functional limitations in those tasks, will be critical to increase equitable employment for persons with disabilities in the skilled trades.

KEYWORDS

Skilled trades workers, persons with disabilities, vision impairment, hearing impairment, cognitive impairment, physical impairment, functional limitations, assistive devices, assistive technology, accommodations.

INTRODUCTION

Skilled trades workers play a vital role in Canada's economy (Government of Canada, 2024). This population provides essential services across construction, manufacturing, automotive power, and services. A career in the skilled trades offers many individuals stability, strong earning potential, and opportunities for career advancement (Government of Canada, 2021). However, Canada is facing a significant shortage of skilled workers, due to the retirement of the aging workforce and a lack of younger individuals pursuing trades (Government of Canada, 2024; Su et al., 2024). Employment and Social Development Canada projects a shortage of over 220,000 certified skilled trades workers (i.e., journeypersons) between 2024 and 2028. As an illustration of current demand, on February 5th, 2026, Employment and Social Development Canada's Job Bank showed 16,662 skilled trades job openings representing 31% of available positions within the national repository (Government of Canada, 2026). This employment gap poses a challenge for economic stability. Addressing this shortage is critical (Canadian Apprenticeship Forum, 2023).

The retirement-related skills shortage is further compounded by early workplace exits due to injury or disability (Scott et al., 2018). An investigation found that workers with a permanent injury, retired, on average, earlier than their uninjured coworkers. Risk factors associated with early retirement included age at the time of the injury or illness, lower income, and physically demanding job tasks (Scott et al., 2018).

Persons with disabilities are an overlooked and under-appreciated source of talent (Lengnick-Hall et al., 2008). Disability is defined broadly, encompassing a wide range of impairments or limitations (Government of Canada, 2023). Persons with disabilities continue to face unemployment and underemployment. In Canada, the employment rate of persons with disabilities is 59%, which is considerably lower than the 80% employment rate of those without a disability (Statistics Canada, 2023). Of the persons with disabilities who are not employed and not in school, 39% (i.e., nearly 645,000 individuals) had the potential to work (Statistics Canada, 2023). With appropriate workplace supports and accommodations, persons with disabilities can thrive and make valuable contributions to the workplace (Stokar & Orwat, 2018). There is substantial potential for people with disabilities to fill existing skill

gaps; however, organizations lack an understanding of how to accommodate persons with disabilities within skilled trades occupations (Bishop-Williams et al., forthcoming).

Several disability management best practice guidelines exist to support and guide organizations in including persons with disabilities. The CSA Group (CSA Z1011, 2024), Canadian Centre for Diversity and Inclusion (2023), and the Canadian Human Rights Commission (2026) provide resources to help employers develop inclusive practices. Legislative frameworks, such as the Employment Strategy for Canadians with Disabilities (2024) and the Accessible Canada Act (2019) support hiring, onboarding, retention, management, return to work, and advancement. However, these guidelines remain high-level and lack specificity for skilled trades environments

Accommodations best practice recommends a case-by-case approach, including modified duties, job restructuring, and flexible work hours (Canadian Human Rights Commission, 2026). However, many accommodations reposition persons with disabilities into roles adjacent to skilled trades occupations but may not enable them to perform the essential duties and tasks of skilled trades. As a result, persons with disabilities continue to be an underutilized source for mitigating the skills shortage.

Workplace support solutions, encompassing assistive products, supportive devices, and job or environmental accommodations, offer opportunities for persons with disabilities to (re)enter and remain in the skilled trades by enabling the performance of essential job tasks rather than reassigning workers to alternative roles. These solutions are often identified at the sector level, with limited task-specific detail. Many individuals rely on multiple support solutions, underscoring the need for an integrated task-level approaches.

The aim of this environmental scan is to identify workplace support solutions relevant to skilled tradres. By empowering employers and persons with disabilities with an inventory of sector-specific and task-specific workplace support solutions, this study aims to support the inclusion of persons with disabilities in the skilled trades. The specific objective of this environmental scan is to synthesize resources in Canada, the United States, and beyond that describe assistive products, supportive devices, and workplace accommodations to support the participation of people with disabilities in the skilled trades workforce.

METHODS

Study Design and Protocol

This environmental scan aimed to identify workplace support solutions and workplace accommodations that support people with disabilities to work in skilled trades occupations within the construction, motive power, industrial, and service sectors. The approach was informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018) to enhance transparency and replicability. The environmental scan methodology was selected to complement a systematic literature review (Du et al., under review) and assess a broad range of practice- and industry- led innovations relevant to the rapidly changing environment of workplace support solutions. Scan methods were determined *a priori* and were time-stamped (Feb 14, 2024) in an internally maintained protocol; the research protocol was not registered or published.

Key Terms and Classification Frameworks

Disability was defined in accordance with the Accessible Canada Act (2019) and the Canadian Standards Association (CSA Z1011, 2024), which conceptualizes disability as an impairment or functional limitation that, in interaction with barriers, restricts full and equal participation in society. Aligned with federal policy, disability types were categorized using the Government of Canada's ten disability categories identified by Statistics Canada (2023).

Functional limitation was defined as a restriction in an individual's ability to perform tasks or activities resulting from an impairment or related disability, as described by the Government of Canada (2023). While workers are not required to disclose their impairment or diagnosis, employers may need to understand functional limitations to implement reasonable accommodations. Functional limitations relevant to workplace support were identified using the 113 categories adopted by the Job Accommodation Network (JAN, 2026).

Work activities were classified using the General Work Activities framework developed by O'NET (2025), which includes 41 categories applicable across occupations. Each support solution was mapped to the work activities it was designed to support and linked to common task demands.

Where information about a specific skilled trades occupation was available, occupations were categorized using the 2021 National Occupational Classification (NOC) System (Government of Canada, 2024). Industry sectors were classified using the North American Industry Classification System (US Census Bureau, 2026; Statistics Canada, 2022) to reflect the physical and organizational context in which the support solutions were applied.

Eligibility Criteria

Initial eligibility criteria were broad: all relevant or potentially relevant webpages were included in the initial screening. Sources were not excluded by date, language, publication type, or other characteristics. Eligible sources included websites, reports, articles, and blog posts produced by government agencies, health and safety organizations, trade associations, assistive product manufacturers, or sector-specific organizations.

Sources were primarily excluded if they were missing one of the three main components of the search strategy: disability, workplace support solutions, or the skilled trades. Sources that focused solely on industry tools or technological advancements without reference to disability, functional limitations, or workplace accommodation were excluded. Sources that focused entirely on diversity, equity, and inclusion practices, such as a Disability Ambassador in the workplace, were also excluded. These practices were outside the scope of the environmental scan, which aimed to identify practical, task-level support solutions for skilled trades workers with disabilities. ources focused solely on general accessibility without skilled-trades application were excluded. Similarly, assistive products described without a clear workplace context in the trades were not included, to maintain relevance.

Information Sources and Search Strategy

A web-based search strategy was used to identify relevant workplace support solutions. Searches were conducted in English,) and followed a consistent conceptual structure combining disability-related terminology, employment and workplace accommodation terms, and skilled trades occupations or sectors including construction, automotive and motive power, manufacturing, or industrial, and service trades.

Search terms were iteratively refined during the search process to reflect terminology encountered in disability, employment, and skilled trades contexts. Refinement continued

until the search was deemed exhaustive and no new potentially relevant links were identified in the first 100 results.

Planning for the environmental scan and preliminary pretests occurred on February 14, 2024. The searches occurred from February 27, 2024, to Aug 20, 2024, and additional screening ensued from March 12, 2025, to April 29, 2025.

Source Selection

For each search, the first 100 results were screened for relevance, corresponding to the first five pages of search results. This approach aligns with established environmental scanning practices. Potentially relevant sources were identified based on explicit reference to workplace support solutions or workplace accommodations supporting people with disabilities in skilled trades settings. A snowball strategy was applied to locate additional relevant materials through hyperlinks, references to related tools or technologies, or affiliated organizational content.

Full Source Review

All included sources were reviewed in full by four research team members Product descriptions, documented solutions, and available examples were examined. Articles and blog posts were reviewed for explicit references to accommodations supporting workers with disabilities in skilled trades occupations.

Data Charting

Data were systematically extracted for key variables from each source. Data were extracted independently by four research team members. Extracted data included the support solution, solution descriptions, work activity supported, relevant functional limitations overcome, disability type, trade occupation when specified, and the skilled trades sector in which the solution was applied.

Data Synthesis

A thematic analysis using an inductive approach was conducted to identify patterns and relationships among the workplace support solutions identified (Braun and Clarke, 2006). Solutions were grouped according to the disability types and/or functional limitations

they addressed; themes emerged directly from the data. Results are synthesized based on the impairment or disability type addressed by each solution.

RESULTS

Selection and Characteristics of Sources

Searches were conducted across the four skilled trades sectors and the skilled trades, resulting in 440 preliminary sources for consideration (Figure 1). Following the full review of potentially relevant sources, 124 unique workplace support solutions specific to support persons with disabilities in the skilled trades were identified.

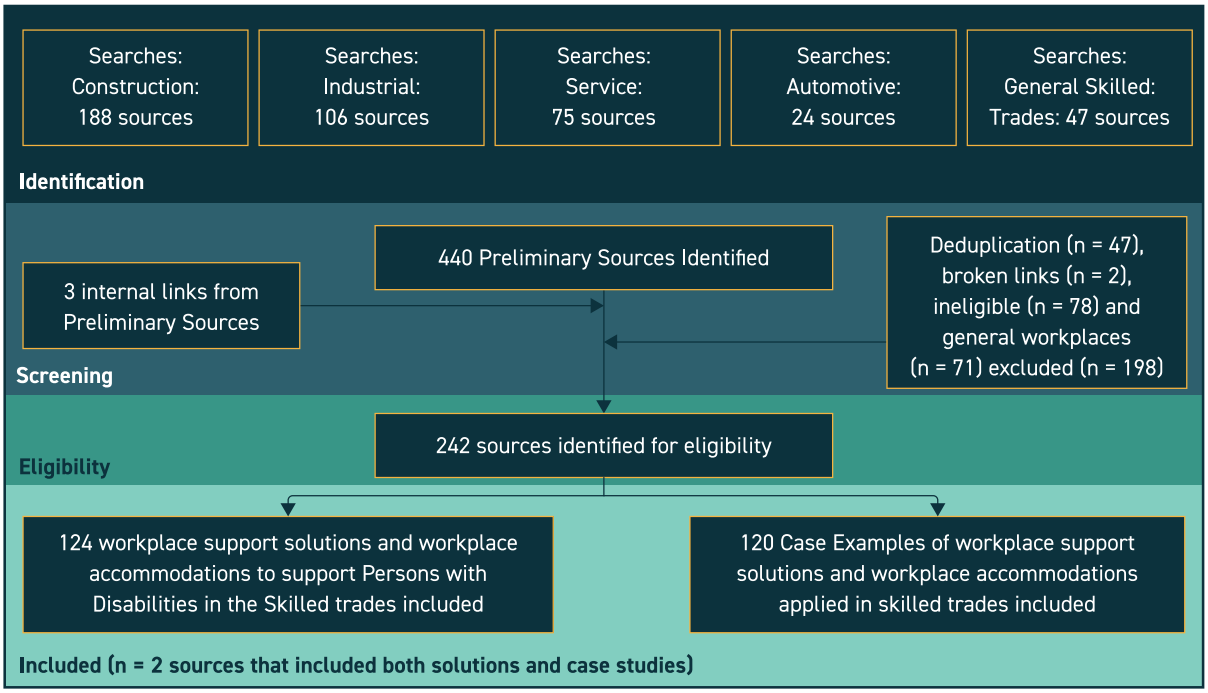

Figure 1. Search and inclusion counts of sources identified and considered for the environmental scan of disability-related terms, employment and workplace accommodation terms, and skilled trades occupations or sectors terms.

Environmental Scan Findings

Across the 124 support solutions to supporting persons with disabilities in the skilled trades, the majority were related to physical supports for mobility, flexibility, dexterity, or pain-related conditions (n=81, 65.3%) (Table 2). Substantially fewer solutions for vision (n=26, 21.0%), hearing (n=10, 8.1%), and learning, cognitive, memory, or mental health (n=7, 5.6%) were identified in the environmental scan.

Table 2. Comprehensive synthesis of workplace support solutions and workplace accommodations identified via the environmental scan of supports for persons with disabilities in the skilled trades workforce.

Vision

Task Impacted/ Supported	Workplace Support Solutions and Workplace Accommodations Identified	Description and Application	Support Solutions and Workplace Accommodations Applied or Recommended *Industry(ies): Trade (if specified)*
Working on Computers	Braille Keyboard	A specific type of keyboard where the keys have raised braille dots on them	Service: Appliances Service All sectors (general trades): Apprentice training
	Screen Magnification	An accessibility feature on a computer designed to help users with low vision by enlarging content on a screen.	Service
	Keyboard with Large Print	A keyboard with oversized keycaps featuring large letters, numbers, and symbols, typically using high contrast colour schemes (e.g., black on yellow or white) to enhance visibility.	Service
	Font Magnifiers for Computers	Tools (software or hardware) that magnify on-screen text.	Service
	Screen Readers Text-To-Speech Tools	Coverts written text on screen into speech	Service: Appliances Industrial
Colour Filters	Colour Filter Glasses for Colour-Blind	Colour filters help colour-blind distinguish different colours.	Construction: Electrical Industrial
	Colour Vision Deficiency (CVD) Information & Products	Colour filters (e.g., red contact lenses or prescription glasses) and colour identifying talking devices can help individuals with colour vision deficiencies distinguish and identify colours.	Construction
Work Area Lighting	Alternative Lighting	Alternative lighting, such as incandescent and LED fixtures, without harmful UV radiation.	Construction
	Headlamps	Headlamps may be adjustable (swivel) to direct light to a certain area, hands-free.	Construction Motive Power: Autobody and collision technician, Automotive service technician
	Lighted Reading Glasses	Lighted reading glasses provide magnification and illumination.	Construction

Magnifiers	Head-Mount Magnifiers	Glasses, visors, and other devices that allow magnification.	Construction
	Portable Video/Electronic Magnifiers	Small, portable video magnifiers use a camera and screen to display live, enlarged views of printed materials or objects.	Construction
	Virtual Reality (VR) Glasses	VR goggles paired with a smartphone and foot switch enable handsfree control of zoom and exposure for clear viewing, with a protective light/UV filter placed in front of the goggles to shield both the user and equipment.	Construction: Welder Motive Power
	Lighted Reading Glasses	Lighted reading glasses combine magnification and illumination.	Construction
Navigation	Detectable Warning Surface	Tactile warning surfaces provide detectable ground cues that alert people who are blind or have low vision of pedestrian hazards or changes.	Construction
	Directional Sounders	Directional sounders are audible devices that can lead you to safety.	Construction
	Heated Mats	Slip-resistant mats that can be heated to help reduce ice and snow outside buildings.	Construction
	Industrial Mirrors	Mirrors sized and standardized for industrial settings.	Construction
	Talking GPS And Maps	Talking GPS technology provides voice output for people with vision impairments. GPS serves as a navigation aid for vehicles such as cars, airplanes, and ships, and is increasingly integrated into cell phones, personal devices, and vehicle tracking systems.	Construction
	Large Print Visual Aids	Large print visual aids for training and work area communication.	Industrial
	Amplified Floor Signage For Emergency Exit Plans	Amplified floor signage for emergency exit plans.	Industrial
Measuring	Tools With Braille for Measuring Distances	Tools that incorporate Braille markings to support measuring distances.	Construction
	Talking Tape Measure	Talking tape measures produce an auditory output of the desired length being measured.	Construction
Operating Mirror vehicles	Vehicle Mirrors	Mirrors are used in industrial settings for vehicles.	Construction
	Vehicle Rear Vision System	A vehicle rear vision system might be used as an accommodation when a worker's ability to hear or see the environment is compromised.	Construction

Other	Braille on Nameplate	Put braille on staff nameplates.	Construction, Industrial, Motive Power, Service

Hearing

Task Impacted/ Supported	Workplace Support Solutions and Workplace Accommodations Identified	Description and Application	Support Solutions and Workplace Accommodations Applied or Recommended *Industry(ies): Trade (if specified)*
Communicating with Others	Clear Face Masks for Lip Reading	Masks with a clear section near the mouth allowing for lip reading.	Construction
	Portable Text Communication Devices	Portable text communication devices are a type of assistive technology that are designed for one-on-one communication.	Construction
	Private or On-Premises Paging Systems	An on-premises paging system can be used to communicate emergencies and important information to employees who are deaf or hard of hearing.	Construction
	Two-Way Radio Texting	Two-way radios with texting capabilities can be used when audio communication is unclear or when a worker is deaf or hard of hearing.	Construction
	Tele-typewriter (TTY), Tele-communication Device For The Deaf (TDD), Telecommunications Relay Service (TRS) Textphones, Minicoms	A TTY (TDD) device allows individuals who are deaf, hard of hearing, or have speech impairments to communicate by typing messages that are transmitted over phone lines and displayed on another TTY device, with incoming alerts provided through visual (lights) or vibration signals. The Telecommunications Relay Service (TRS) is a free, 24/7 service that enables communication between TTY users and standard phone users by dialing a toll-free number or 711, where a trained communications assistant relays messages exactly as spoken, typed, or signed.	Industrial: Truck driver
	Alerting Devices	Alerting devices notify individuals who are deaf or hard of hearing to environmental sounds, such as phone calls,	Construction

		doorbells, or emergency alarms using visual signals or vibrations.	
Operating Motor Vehicles	Vehicle Mirrors	Mirrors used in industrial settings for vehicles.	Construction
	Vehicle Rear Vision System	A vehicle rear vision system might be used as an accommodation when a worker's ability to hear and see the environment is compromised.	Construction
Hearing Aid Accessories	Hearing Aids Covers	Protective covers that shield hearing aids from external factors (i.e., water, sweat, humidity).	Construction
	Alternative Lighting	Alternative lighting, such as incandescent and LED fixtures, without harmful UV radiation.	Construction

Learning, Cognitive, Memory, and Mental-Health

Task Impacted/ Supported	Workplace Support Solutions and Workplace Accommodations Identified	Description and Application	Support Solutions and Workplace Accommodations Applied or Recommended *Industry(ies): Trade (if specified)*
Work Area Lighting	Adjustable Lighting	Adjustable lighting options, allow individuals to customize light levels, reducing sensory overload and supporting focus, safety, and effective task performance.	All sectors (general trades)
	Light Diffusers	Strategic placement of lighting to reduce glare can create a more visually comfortable workspace for autistic employees who are sensitive to intense or direct light.	All sectors (general trades)
	Light Filters	Light sources to reduce glares can contribute to a visually comfortable workspace for autistic employees as they may be sensitive to intense lighting.	All sectors (general trades)

Supporting Memory	Two-Way Radio with Texting	Two-way radios with texting capabilities can be used when audio communication is unclear.	Construction
Language Deficits (Reading, Writing, Or Speaking)	Colour-Coded Manuals, Outlines, And Maps	Colour-coding materials may assist individuals with reading deficits due to the complicated structure of the material and the size/type of font used in lettering. Coding materials may assist individuals with reading deficits due to the complicated structure of the material and the size/type of font used in lettering.	Construction
	Electronic Dictionaries	Programs that define terms to assist individuals with finding proper words for their needs.	Construction
	Word Prediction/ Completion and Macro Software	Word prediction/completion, and macro software help users type more efficiently by suggesting words, completing partially typed words, and executing multiple steps with a few programmed keystrokes, often combined within a single software program.	Construction

Physical: Mobility, Flexibility, Dexterity, and/or Pain

Task Impacted/ Supported	Workplace Support Solutions and Workplace Accommodations Identified	Description and Application	Support Solutions and Workplace Accommodations Applied or Recommended *Industry(ies): Trade (if specified)*
Adjustable Work Platforms	Adjustable Drafting Tables	Adjustable drafting tables allow individuals to adjust their writing and drawing surfaces.	Construction
	Adjustable Workstations for Industrial Settings	Adjustable desks and tables accommodate mobility aids with use of different chairs, and sitting or standing work preferences to improve comfort, accessibility, and overall work performance.	Construction
	Work Platforms	Adjustable work platforms that raise workers to an optimal working level, with some designs providing wheelchair access when ramps are not feasible.	Construction
Handling Objects	Tire Handling	Devices and equipment that simplify handling vehicle tires.	Construction Motive Power
	Drum Handling	Drum handling is a safe & efficient process of moving and lifting drums in warehouses.	Industrial Motive Power
	Drywall Pan Holder	Mud pan and tape holder attached to the belt.	Construction: Drywall finisher and plasterer
	Ergonomic Fuel Hose Drainer/ Fuel Line Gravity Drainer	The Ergonomic Fuel Hose Drainer® allows hoses to be drained safely after use without awkward lifting, bending, or stooping.	Construction: Truck driver
	Manhole Cover Lifts	Manhole cover lifts make it easy to remove and replace covers with one person.	Construction
	Tool Balancers	Individuals with neck, back, shoulder, and cumulative trauma disorders to the upper extremities may benefit from tool balancers as it is engineered to offset the weight.	Construction
	Deburring Tools	Tools that remove burrs from metal or plastic pipe edges remaining from drilling, grinding, or milling projects.	Construction
Carrying and Moving Material	Motorized Carts	Motorized carts assist individuals with shoulder, neck, back, and upper and lower extremity impairments who have difficulty pushing and/or pulling.	Construction

	Multi-Purpose Carts	Moving or carrying items can be difficult for individuals with limited motor movement. Multi-purpose carts, available in various sizes and designs, help transport items more easily.	Construction
	Winches And Chain Hoists	These are vehicle-mounted devices that hook to materials to help move them by using powered cables and chains.	Construction Industrial
	Accessories For Scooters	Equipment that can be attached to scooters, such as carrying bags/pouches, cane/crutch holders, oxygen tank holders, cupholders, eating trays, writing/reading trays, trailers, rear-view mirrors, umbrellas, and headlights.	All sectors (general trades)
	Stairclimbing Hand Trucks	Stairclimbing hand trucks move loads safely up and down stairs, across flat surfaces, and on or off vehicles or loading docks while keeping loads balanced. They are available in motorized, lightweight, and heavy-duty models for different load requirements.	Construction
	Janitorial Carts	Mobile system for collecting waste, transporting cleaning tools while keeping everything organized with convenient shelving and hooks to store janitorial supplies, such as brooms/ handbags, dustpans, and floor signs.	Construction
	Hitch Systems	Hitch systems can allow an operator to hitch industrial and agricultural equipment from a seated position.	Construction Industrial
Lifting Tools	Aerial Lifts	Aerial lifts, also known as platform or man lifts provide safe access to hard-to-reach heights, often replacing ladders, and include scissor, platform, and maintenance lift designs in various sizes.	Construction
	Ball Transfer Tables	Ball transfer tables or conveyors help move items between workstations, allowing materials to be guided across surfaces instead of being manually carried.	Construction
	Battery Powered Lift Tables	Lift tables that can be operated away from power sources and outlets, offering a wider range of mobility and use.	Construction
	Compact Equipment for Material Handling	Compact material handling devices are portable, adjustable height tools designed for tight spaces to lift and move item. Powered by batteries, hydraulic foot pumps, or hand cranks and sometimes equipped with ball transfer tables.	Construction
	Compact Mobile Cranes	Compact mobile cranes are devices meant to do heavy lifting while also being constructed to be portable and easy to use.	Construction: Truck driver Industrial
	Drywall And Wallboard Lift	The drywall lift allows one person to lift a drywall panel.	Construction: Drywall finisher and plasterer

	Masonry Machine	A masonry machine lifts, moves, and places bricks of various sizes using a bricklaying platform and fixed lifting manipulator with tongs. Mounted on a movable electrohydraulic scissor or column lift and operated via a trolley or articulated jib (sometimes weight compensated), all functions are controlled from the platform, reducing shoulder, arm, and spinal strain while preventing awkward postures.	Construction: Bricklayer
	Vacuum Pick-Up Tools	Equipment designed to perform the lifting, holding, and relocating of small weights while preventing potential damage to the material.	Industrial
	Vacuum Lift	Equipment designed to use vacuum suction cup lifting to hold and relocate heavy weights while preventing potential damage to the material.	Construction
	Truck-Mounted Cranes	Truck mounted cranes are devices meant to do heavy lifting and are mounted to trucks to support this. They are often used in large construction projects.	Construction: Truck driver Industrial
	Electric Lift Tables	An electric lift table is a standard table enhanced with a lifting mechanism that uses electric actuators and a remote control to raise or lower the work surface, with sizes and shapes tailored to user needs.	Construction
	Lift Tables	Lift tables raise objects to an optimal working height, reducing strain from awkward positioning, and are available in multiple sizes with manual (hand crank) or fully electronic operation options.	Construction
	Lifting Aids	Lifting aids help individuals with lifting or carrying restrictions move smaller items safely and can serve as a practical alternative to larger lifting equipment.	Construction
	Lift Gates	These are devices that can be attached to vehicles so they can lift weighted loads or wheelchair users up and safely into the vehicles.	Construction
	Foot-Controlled Lift Tables	Tables that automatically lift and lower by use of floor-attached foot controls	Construction
	Vertical Carousel Storage System	Storage carousel systems use a vertical, Ferris wheel-style mechanism to deliver items directly to the operator via a control unit, saving space, reducing operating costs, and improving efficiency by eliminating walking time in warehouses to retrieve items.	Industrial

	Pallet Shuttle Storage System	An autonomous pallet shuttle system replaces forklifts in rack areas, reducing aisle congestion and maximizing space through narrower aisles and expanded racking, while increasing pallet/SKU capacity and minimizing product and rack damage.	Industrial: Warehouse worker
Working At Heights	Large-Rated Small Step Ladders	Low step ladders designed to support higher weights than typical step ladders.	Construction
	Large-Rated Ladders	Large-rated ladders (loads of up to 500 lbs) vary in the number of steps, whether they have handrails, and if they are single, extension, platform, or step.	Construction
	Lightweight Ladders	These are ladders of various heights with a proportionally low weight for easy carrying and positioning.	Construction
	Compact Ladders	Ladders of various sizes that can be collapsed or made compact and easily transportable.	Construction
	Rolling Safety Ladders	Rolling safety ladders are less steep than regular ladders, therefore, easier to climb; other features include handrails and locking casters.	Construction
Chairs	Mechanic's Seats and Creepers	Support those who work in mechanical or industrial environments and must access areas using awkward posture.	Construction
	Low Task Chair (Commonly Sold as Mechanic Chairs)	Low task chairs allow individuals to sit close to the ground to access low-level objects without bending or kneeling; many are height adjustable.	Construction
	Low Positioned Stools	A stool that is low for those who have difficulties squatting and reaching down.	Construction
Easy Grasp Hand Tools	Brooms	Brooms made accessible for physically impaired individuals.	Construction
	Easy Grip Handles	Handles with materials such as pipe insulation to make them easier to grip.	All sectors (general trades)
	Electric Scissors	Scissors that can be automatically powered to cut without manually making the motions.	Construction
	Ergonomic Scissors	These include scissors with flexible designs for many different uses.	Construction
	Ergonomic And Pneumatic Tools	Ergonomic hand and pneumatic tools support individuals with neck, back, shoulder, and upper extremity limitations by promoting neutral postures, reducing wrist deviation, minimizing vibration, and lowering shoulder strain through lightweight design. These tools avoid stressors like misaligned finger grooves, sharp edges, and single finger triggers, and may use tool balancers to support heavier tools. Tools can include	Construction

		features such as spring-loaded returns on scissors and pliers to reduce repetitive strain.	
	Lightbulb Changers	This light bulb changer is a solution to replacing the light bulbs in tall ceilings.	Construction
	Lock Mechanisms and Key Grips	Some individuals have difficulty gripping and twisting keys to operate locks. Key grips assist with less grasping, and keyless locks may be helpful.	Construction
	Box Cutters	Easy to use cardboard cutting knives that retain a natural grip and wrist posture for individuals with impaired hand movements.	Construction
	Torque Multipliers	Wrenches and other equipment that easily increase the tension and pressure that can be applied for industrial work.	Construction Industrial
	Extra Grip Gloves	Gloves with special material coated on the palm to increase gripping strength on most surfaces.	Construction
Fine Motor Deficits	Anti-Tremor Gloves	Gloves are designed to assist with fine motor tasks for individuals who experience tremors.	Construction
Reducing Hand-Arm Vibration	Anti-Vibration Tool Wraps	Anti-vibration tool wraps reduce vibration from hand and pneumatic tools, helping lessen the impact of power tools, hammers, and other pneumatic devices.	Construction
	Anti-Vibration Gloves	Anti-vibration gloves reduce hand-arm vibration from power tools and pneumatic equipment, helping lessen strain and discomfort for individuals affected by vibration.	Construction
Mobility/ Getting Around on Site	All-Terrain Scooters	Scooters designed to traverse outdoor environments, including sand, soft wet ground, uneven surfaces, curbs, and slopes.	Construction
	Large-Rated Scooters	Mobility scooters can assist individuals with obesity who have difficulty walking and are available in high-capacity models rated to safely, support users up to 400 lbs.	Construction
	All-Terrain Wheelchairs	All-terrain wheelchairs are designed to withstand harsh conditions and traverse outdoor environments, including sand, soft wet ground, uneven surfaces, curbs, and slopes.	Construction
	Convex Mirrors	Convex mirrors are mirrors that allow users to see around corners and blind spots.	Construction
	Evacuation Devices	Emergency evacuation devices help safely move individuals with mobility impairments up or down stairs or across rough terrain during building evacuations.	Construction
	Heated Mats	Slip-resistant mats that can be heated to help reduce ice and snow outside buildings.	Construction

	Long-Handled Mirrors	The long-handled mirror makes it easier to see with a limited range of motion.	Construction
Worksite Access	Alternative Locks	Lock's that do not require a key for entry, such as keypad, card access, or biometric locks.	Construction
Prosthetic Accessories	Prosthetic Accessories for Woodworking and Carpentry Tools	Prosthetic accessories for individuals with amputations or hand dysfunctions to use for woodworking and carpentry.	Construction: Cabinet maker, carpenter
Walking and Standing	Custom Shoes	Shoes made to suit specific needs and measurements, for safety and casual applications.	Construction
	Anti-Fatigue Matting	Anti-fatigue matting provides a cushioned buffer between the floor and the body, reducing strain for individuals who stand for prolonged periods and is available in various sizes, including custom-made options.	Construction
	Wearable Anti-Fatigue Matting	Wearable anti-fatigue matting includes non-slip overshoe coverings and anti-fatigue insoles that improve walking stability and reduce fatigue while standing or moving.	Construction
Operating A Vehicle	Air Ride Seat for Heavy Equipment	Air suspension seats use a pneumatic “air spring” system with pressurized air to absorb shocks and vibrations as a vehicle travel and reacts to the road.	Construction: Heavy equipment operator: Dozer, Heavy equipment operator: Excavator, Heavy equipment operator: Tractor-loader-backhoe, Tower crane operator, Mobile crane operator
	Anti-Vibration Seats	Seat covers designed to reduce strain from vibration and shaking from vehicles.	Construction: Heavy equipment operator: Dozer, Heavy equipment operator: Excavator, Heavy equipment operator: Tractor-loader-backhoe, Tower crane operator, Mobile crane operator
	Cushions For Vehicles	Cushions to help reduce stress and pain in individuals with chronic back pain when riding in or driving vehicles.	Construction
	Parking Brake Extension for Trucks	An extended lever to add to a car's parking brake for easier activation.	Construction: Truck driver
	Pedal Extenders	Accessories that add extra length to pedals for individuals with physical impairments so they can use them fully.	Construction
	Left-Foot Gas Pedal	A left foot gas pedal consists of linkage enabling an individual with a right-foot impairment to operate the accelerator of a vehicle comfortably and safely.	Construction

	Extended Tractor Steps	Additional steps for entering and exiting tractors and their vehicles that are high off the ground and require some vertical movement to mount and operate.	Industrial: Truck driver Motive Power: Transport trailer technician
	Vehicle Mirrors	Mirrors used in industrial settings for vehicles.	Construction
	Gear Shift Adapter/ Extension	Accessible attachment to a car's gear shift that allows physically impaired individuals to drive their car more easily.	Construction
	Steering Grips	Steering grips assist individuals with fine motor limitations in gripping and turning steering wheels.	Construction: Truck driver
	Long-Handled Mirrors	The long-handled mirror makes it easy to see for people with a limited range of motion.	Construction
Arm Extenders	Reachers	Reachers can extend to various lengths and can grasp items for those with limited reach or strength.	Construction
	Robotic Mower with Radio Remote Control	The robotic mower with radio remote control reduces the physical demands related to manual mowers.	Service: Landscape horticulturist
Task Automation	Physical Automation (Robotic Machines/Tools) Or Digital Automation (Workflow Software, Sensors Triggering Actions)	Task automation uses tools, software, or machines to perform repetitive or routine tasks with minimal human effort.	All sectors (general trades)

Support Solutions for Vision Impairments

The environmental scan identified 26 support solutions and accommodation-related approaches to eight functional challenges for individuals with vision-related disabilities in skilled trades. These functional challenges were related to tasks requiring visual precision, safe navigation, and interaction with equipment. Common barriers included difficulty reading fine print or measurements, reduced peripheral vision affecting hazard awareness, impaired depth perception when operating machinery, and challenges distinguishing colours or contrasts used in safety signage, wiring, or plans. Sensitivity to glare and bright lighting was also frequently noted as a factor that can reduce comfort, accuracy, and efficiency in trade environments.

A range of visual, tactile, and environmental support solutions were identified. Computer-based work, including documentation and skilled trade-specific software, was supported through screen readers, screen magnification, text-to-speech tools, or Braille displays. These solutions enabled access to digital plans, computer-aided design applications, and administrative tasks. Mobile applications, such as object and text recognition tools, expanded information access in field settings.

Several interventions focused on adjustments to visual input in physical workspaces. Adjustable task lighting, glare reduction, and high-contrast environments supported detail recognition and reduced eye strain. Magnification tools, including handheld, head-mounted, and digital magnifiers, enabled workers to inspect small components and read labels or measurements accurately. For individuals with colour vision deficiency (i.e., colour-blindness), colour-filtering glasses and digital colour-enhancement tools improved interpretation of colour-coded information.

Finally, navigation and safety were often supported through tools providing auditory or tactile feedback, enhancing spatial orientation in complex or hazardous environments. Measuring tools with Braille markings or voice output supported measurement tasks. Limited work also addressed vehicle and equipment operation, with rear-vision systems and high-contrast displays improving situational awareness and safety.

Support Solutions for Hearing Impairments

The scan identified communication, safety, and training-related barriers for individuals with hearing-related impairments in skilled trades, where work is often conducted in noisy, dynamic, and high-risk environments. Key challenges included difficulty receiving verbal instructions, reduced informal communication with coworkers, and missing auditory cues

such as alarms or approaching vehicles. These barriers increased safety risks, constrained situational awareness, and could contribute to social isolation or reduced participation in team-based tasks.

Communication supports were the most frequently identified support solutions for hearing-related impairments. Visual and text-based systems, including portable text communication devices, speech-to-text tools, and two-way radios with texting capabilities, enabled real-time information exchange. Clear face masks allowed for lip reading during in-person interactions. For phone-based communication, TTY devices facilitated scheduling and reporting.

Safety and alerts were primarily addressed through visual or vibrating alert systems that converted environmental sounds, such as fire alarms or incoming calls, into light or tactile signals. On-site paging systems provided text-based notifications. For vehicle and equipment operation, enhanced visual supports such as wide-angle mirrors and rear vision systems reduced reliance on auditory cues.

Additional supports included protective covers for hearing aids to support use in outdoor or high-humidity environments and alternative lighting to ease visual communication.

Support Solutions for Learning, Cognitive, Memory, and Mental Health Impairments

A range of cognitive, sensory, and communication-related barriers affecting individuals with learning, cognitive, and memory and mental health-related disabilities in skilled trades environments were identified. Challenges were most associated with sensory stimulation, information processing, memory, or language. Individuals with neurodevelopmental conditions may experience heightened sensitivity to lighting or visual clutter, which increases cognitive load and negatively impacts task performance.

Although fewer than the other categories, some workplace modifications focused on reducing sensory stimulation and supporting sustained attention or memory retention. Adjustable task lighting and light filters were used to reduce glare and allow workers to tailor lighting conditions to individual tolerances. Text-based communication tools, such as two-way radios, enabled workers to review instructions and task-related information; these tools reduced reliance on short-term memory and minimized errors in complex or multi-step tasks. These were particularly relevant in fast-paced or noisy environments where verbal instructions may be difficult to process.

Support solutions for language addressed challenges related to reading, writing, or expressive communication. Colour-coded manuals, outlines, and maps supported

comprehension and navigation of technical information via visual content and reduced dense text. Electronic dictionaries and word prediction software further supported written communication and documentation. Macro software reduced cognitive demand by automating repetitive steps.

Support Solutions for Physical Impairments

This scan identified a wide range of support solutions (n=81) addressing physical impairments affecting mobility, strength, reach, dexterity, endurance, and pain management in skilled trades settings (Table 2). In total, 16 barriers were identified; these were typically associated with manual material handling, sustained or awkward postures, repetitive tasks, working at heights, and navigating large or uneven worksites.

Adjustable work surfaces were common accommodations identified in this category. Height-adjustable drafting tables, industrial workstations, and work platforms supported workers who use mobility aids, those needing to alternate between sitting and standing, or individuals requiring customized positioning to reduce strain. Platforms and ramps also improved access for wheelchair users.

Support solutions for material handling and object movement represented a substantial category. Devices such as motorized carts, winches, hoists, lift gates, and compact mobile cranes reduced the physical demands of lifting, carrying, pushing, and pulling. Many types of specialized handling tools enabled operation while reducing load on upper extremities and spine. Tool balancers further mitigated strain by offsetting tool weight during repetitive or overhead tasks.

Ergonomic and dexterity-focused accommodations supported fine and gross motor function. Easy-grip hand tools, torque multipliers, ergonomic tools, spring-loaded scissors, and electric cutting tools reduced required grip strength and awkward wrist postures. Anti-tremor and anti-vibration gloves addressed fine motor control and vibration exposure. Key grips, alternative locking mechanisms, and reacher tools supported limited grasp or range of motion.

Supports for working at heights included lightweight, compact, large-rated, and rolling safety ladders. To reduce crouched and low positions work, support solutions included mechanic's seats, low task chairs, and stools. In some environments, aerial or scissor lifts replaced ladder use, improving safety and access.

Mobility and site navigation were supported through all-terrain scooters and wheelchairs, convex mirrors to address blind spots, and heated anti-slip mats for outdoor

access. Storage systems, such as vertical carousel storage and pallet shuttle reduced walking distances and manual retrieval demands.

Vehicle and equipment operation accommodations included air-ride and anti-vibration seating, pedal extenders, left-foot accelerators, and parking brake adaptations. These supports improved safe operation for individuals with lower-limb, upper-limb, or spinal impairments. Task automation, including remotely operated equipment, further reduced physical demands in some contexts.

DISCUSSION

This environmental scan addresses a critical workforce challenge: skilled trades face persistent labour shortages that threaten economic stability and growth while leaving a large group of potentially eligible workers underutilized (Lengnick-Hall et al., 2008). To address this gap, this scan was designed to respond to two objectives: (1) synthesize available resources describing workplace support solutions that support inclusion in skilled trades across Canada; and (2) collate concrete examples of how these support solutions are applied to address functional limitations in real skilled trades work settings. Despite progress, persons with disabilities continue to experience lower employment rates than those without disabilities (Statistics Canada, 2022). Workplace support solutions provide an important mechanism for accommodation, and can support persons with disabilities in thriving and contributing meaningfully at work (Stokar & Orwat, 2018; Stumbo et al., 2009; Morash-Macneil et al., 2017). Related to accommodations, best practice guidance emphasizes individualized plans developed with the input of the person to be supported (Canadian Human Rights Commission, 2026; Jetha et al., 2019). Accordingly, high-level guidance often lacks implementation detail for skilled-trades settings (Accessible Employers, 2021; Accessibility Standards Canada, 2025; AODA, 2026; Connecticut, 2025; Winiarski, 2025).

Across all sources, most identified support solutions supported physical impairments: over 65% of identified solutions addressed mobility, flexibility, dexterity, or pain-related functional limitations. In contrast, fewer than 10% targeted hearing or cognitive disabilities, including learning, memory, or mental health-related impairments. This imbalance is notable given the high prevalence of mental health (38.6%), learning (20.7%), and memory-related (18.2%) impairments among persons with disabilities across Canada (Statistics Canada, 2023). Overall, the availability of support solutions for some impairment types, especially cognitive, may influence uptake of such solutions in the workforce and their application within skilled trades. Evidence shows supportive tools can drive large gains in productivity and task completion for workers with intellectual disabilities (Morash-Macneil et al., 2017).

Among persons with at least one disability in Canada, 27.4% report vision impairments (Statistics Canada, 2023). However, only 26 (21.0%) support solutions identified in this scan were designed for vision-related disabilities, and most addressed mild or moderate impairments (e.g., magnifiers) rather than solutions for blindness (e.g., tactile or auditory systems). Many vision-related solutions addressed sensory overstimulation rather than reduced acuity per se. A lack of robust solutions for low-vision workers may explain why over 15% of participants in a U.S. interview study reported dissatisfaction with the supports

available for their jobs (McDonnall et al., 2023). However, those frustrations centered primarily on accessing software and websites, tasks less common in skilled-trades roles.

Support solutions for skilled trades workers with hearing impairments were uncommon in this analysis, with only 8.1% of identified solutions designed to support this population. However, among persons with a disability in Canada, the prevalence of hearing impairments is 20.7% (Statistics Canada, 2023). In this scan, communication solutions often reduced the burden on an impaired sense by reformatting information to another input, such as replacing two-way-radios with two-way-texting.

In contrast to other impairment types, support solutions for physical impairments were more common, representing 65.3% of unique solutions identified and supporting a diverse range of tasks for skilled trades workers. Physical support solutions often included adjustments to other equipment that allowed for the use of mobility devices, such as wheelchairs or reacher tools, in tandem with equipment. Many solutions evolve incrementally through refinement rather than fundamental task changes (Cowan et al., 2012).

Broader disability management systems are needed to address the needs of skilled trades workers: workplace support solutions should be viewed as one component of these broader systems. Effective inclusion requires coordination with training, supervision, workplace culture, and policy supports; multi-sector, multi-pronged disability-management approaches are typically more effective than single-intervention approaches (Tompa et al., 2008). Previous reviews found few evaluated support-solution interventions for skilled trades in the literature (Du et al., under review); therefore, continued evaluation is needed to identify gaps, assess effectiveness, and promote translation into practice, especially for sector-specific application of in the skilled trades.

Application of Findings

Employers are often not proactive in planning for disability inclusion, which limits workforce participation (Lengnick-Hall et al., 2008). Improved awareness of support solutions may increase equitable access for workers who would benefit from them (Steel, 2019). Access to appropriate support solutions is associated with higher productivity (Ripat & Woodgate, 2017; Morash-Macneil et al., 2017; Yeager et al., 2006) and sustained employment (Ripat & Woodgate, 2017).

The specific examples of support-solution use compiled in this scan may also support reintegration into essential job duties, which may reduce reliance on job restructuring. Early workforce exit is more common among workers with permanent impairments, especially as they age (Scott et al., 2018; Welch et al., 2010). Case-by-case accommodation planning remains critical because workers often use different combinations of support solutions in

personalized ways (Wahidin et al., 2018). Further, persons with disabilities must be aware of their options, supported in exploration, respected in their preferences, and provided with ongoing servicing for support solutions to be accessed effectively and equitably (Steel, 2019). Participants with vision impairments have previously described that identifying, learning, and integrating support solutions can be challenging (Wahidin et al., 2018); the case examples presented here may support decision-making and problem-solving in real work contexts.

The findings of this environmental scan also support the development of inclusive hiring practices for skilled trades employers, who have reported a lack of informational resources or awareness of available support solutions for employees in skilled trades (Bishop-Williams et al., forthcoming).

Limitations

Some limitations should be considered when interpreting the findings of this study. First, this scan reflects a rapidly evolving field (Cowan et al., 2012) and thus the findings represent a cross-sectional snapshot in time. Results would likely differ if the search were repeated (Nagi et al., 2020). However, the overall trends, such as limited availability of support solutions for hearing and cognitive impairments compared to physical impairments would likely remain. Second, algorithmic ranking and recency biases may influence results, though screening the first 100 links broadens coverage (Ziakis et al., 2019).. Third, while this list is extensive, it is not exhaustive; it provides an overview of available solutions and industry practices at the time of searching.

CONCLUSION

The findings of this research demonstrate that an environmental scan of available workplace support solutions produced substantially more trade-specific and impairment-specific applications than a systematic review of the same topic. While workplace support solutions are an ever-expanding and rapidly progressing area of development, limited supports were identified for vision, hearing, and cognitive impairments. More information related to the job-specific tasks and demands of trades work and the development of support solutions that specifically support workers in overcoming task-related functional limitations will be critical to increase equitable employment for persons with disabilities in the skilled trades.

Implications for Accessibility Standards and Recommendations for Trade-Specific Standardization

Amin Yazdani, Katherine Bishop-Williams, Marcus Yung

INTRODUCTION

The findings presented demonstrate that, while the skilled trades are often positioned as a pathway to equitable employment and economic mobility, persons with disabilities continue to face systemic barriers that limit entry, retention, and advancement. These barriers are not solely attitudinal or individual; they are embedded in workplace cultures, employment systems, safety practices, and accommodation structures that have historically not been designed with disability inclusion in mind. On the other hand, disability inclusion practices have been piecemeal and scattered across multiple domains, completely disjointed from the actual realities of skilled trades.

A central implication of this research is that generic, cross-sector accessibility standards, while necessary, are insufficient on their own to drive meaningful inclusion in skilled trades environments. Skilled trades differ considerably from other employment contexts due to their physical demands, complex apprenticeship-based training models, informal hiring practices, safety-critical tasks, and entrenched occupational cultures. Without trade-specific guidance, even well-intentioned accessibility standards risk inconsistent interpretation, uneven implementation, and limited impact.

is the findings contained in this report are therefore uniquely positioned to support and advance sector-responsive accessibility standards that reflect the realities of skilled trades work. The recommendations in this chapter respond directly to the report's findings and emphasize the need for trade-specific standardization as a prerequisite for practical, scalable, and enforceable implementation across Canada.

Trade-Specific Standardization

Across all themes examined in this report, participants consistently described challenges that were contextual, task-dependent, and trade-specific. Employers likewise reported uncertainty, not about the importance of inclusion, but about how inclusion could be operationalized within the constraints of specific trades, job sites, and safety requirements. This gap between intent and implementation points to a fundamental issue: accessibility guidance that is not tailored to skilled trades is difficult to apply in practice.

CISWP-led initiatives such as DOSE, MOSAIC, and Safe WorkSITE, funded by the Workplace Safety and Insurance Board (WSIB), demonstrate the value of designing interventions that are tightly aligned with the realities of specific occupations, tasks, and worksite conditions. These initiatives have shown that when research, tools, and guidance are grounded in the lived conditions of particular sectors and roles, uptake is stronger, implementation is more consistent, and outcomes are more sustainable.

Trade-specific standardization serves three critical functions. First, it translates high-level accessibility principles into concrete, actionable expectations that align with trade tasks and environments. Second, it reduces employer burden by clarifying obligations and dispelling misconceptions that inclusion is incompatible with safety or productivity. Third, it supports consistent application across jurisdictions, worksites, and trades, minimizing reliance on informal or discretionary practices.

The following recommendations therefore emphasize not only what standards are needed, but why they must be explicitly tailored to skilled trades to be effective.

RECOMMENDATIONS FOR FUTURE ACCESSIBILITY STANDARDS DEVELOPMENT

1. Trade-Specific Standard on Inclusive Workplace Culture

The report identifies skilled trades culture as a critical barrier to inclusion, particularly due to normalized attitudes, stigma, and informal workplace norms that marginalize workers with disabilities. Importantly, employers often perceived their workplaces as inclusive while workers reported contrary experiences, a disconnect that inhibits change.

It is recommended that sector-specific standards addressing inclusive workplace culture in skilled trades be developed. Generic inclusion standards do not adequately account for the cultural dynamics of safety-critical, male-dominated, and hierarchically structured trades environments. A sector-specific standard should therefore establish clear requirements for leadership accountability, disability inclusion awareness, and worker consultation mechanisms that are appropriate to trades contexts.

Without such specificity, cultural inclusion risks being treated as aspirational rather than operational.

2. Standardized Employment-Cycle Accessibility Framework for Skilled Trades

Workers with disabilities in this study experienced barriers at every stage of the employment cycle, while employers reported being least prepared to support workers with disabilities during hiring and advancement. The informal nature of trades recruitment and progression amplifies these challenges.

A standardized, trade- and sector-specific employment-cycle accessibility framework is recommended to address barriers from recruitment through advancement. This framework should explicitly consider how accessibility applies within trades hiring practices, on-the-job performance evaluation, and promotion pathways. Without trade-specific guidance, employers may default to exclusionary practices under the assumption that accessibility cannot be reconciled with trade demands.

Standardization in this area would support consistent, equitable implementation while acknowledging the operational realities of skilled trades work.

3. Disability Disclosure Standards for Safety-Critical Trades Environments

Disclosure emerged as a particularly complex issue, with many participants avoiding disclosure due to concerns about stigma, job loss, or stalled progression. In skilled trades, where safety obligations are heightened, the absence of clear, trade-specific disclosure standards creates uncertainty for both workers and employers.

It is recommended that existing employment standards be amended to include explicit guidance on disability disclosure in skilled trades and other high-risk sectors. This guidance must balance safety requirements with psychological safety and non-discrimination, recognizing that disclosure decisions are shaped by the unique power dynamics and cultural norms of trades workplaces.

Generic disclosure guidance is unlikely to address these tensions adequately without sector-specific adaptation.

4. Trade and Disability-Specific Accommodation Frameworks

Participants consistently emphasized that effective accommodations depend on both the type of disability and the specific trade tasks involved. The needs of workers with the same disability varied significantly across trades, while workers in the same trade required different accommodations depending on impairment type.

It is therefore recommended that a modular, trade-specific accommodation framework that provides tailored guidance by disability type and trade context be developed and championed. Such a framework would support practical implementation and reduce employer uncertainty. In contrast, non-specific accommodation standards risk reinforcing narrow or incomplete understandings of disability access, particularly beyond physical impairments.

5. Standardization of Accessible Tools, Equipment, and PPE in Skilled Trades

This research identified significant gaps in access to tools, equipment, and PPE. Existing standards partially address these issues but do not consistently reflect the full range of trades tasks or disability types.

Trade-specific accessibility standards should expand guidance on tools, equipment, and PPE compatibility, ensuring alignment with real-world trade applications. Standardization in this area is particularly critical given the safety-critical nature of skilled trades and the risk of exclusion when equipment is not designed with diverse users in mind.

6. Accessible Apprenticeship and Certification Pathways

While apprenticeship environments were sometimes perceived as safer for disclosure, accessibility supports varied widely across training institutions and certification bodies. A lack of standardization contributes to fragmented experiences and inconsistent outcomes.

It is recommended that accessibility standards explicitly address trade-specific apprenticeship training, assessment, and certification pathways. Standards that fail to reflect the structure of trades training systems risk being poorly implemented or unevenly enforced.

IMPLEMENTATION AND THE RISKS OF NON-SPECIFIC STANDARDS

Across all recommendations, a consistent theme emerges: without trade-specific standards, implementation becomes discretionary, inconsistent, and vulnerable to dilution. Employers may struggle to interpret their obligations, workers may experience uneven access to supports, and accountability mechanisms may remain weak.

Trade-specific standardization is therefore not merely desirable, it is essential to achieving the objectives of accessibility legislation and ensuring that standards result in real, measurable change in skilled trades workplaces.

CONCLUSION

Our findings underscore an urgent need to move beyond generalized approaches to accessibility and toward standards that reflect the unique cultures, tasks, and safety realities of skilled trades work. Persistent cultural exclusion, inconsistent employment practices, complex disclosure dynamics, and uneven accommodation access reveal systems that remain misaligned with the lived experiences of workers with disabilities.

The findings herein highlight a critical opportunity to shift skilled trades cultures and accessibility by advancing trade-specific accessibility standards that translate high-level principles into actionable, practical guidance. Without such specificity, implementation risks being fragmented and ineffective. With it, Canada can meaningfully expand equitable participation in the skilled trades, strengthen workforce resilience, and build inclusive trades systems capable of meeting the country's future social and economic needs.

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