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FACULTY PERSPECTIVES ON OCCUPATIONAL HEALTH AND SAFETY TRAINING IN SKILLED TRADES EDUCATION: CURRENT LANDSCAPE, GAPS, BARRIERS, AND RECOMMENDATIONS

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Faculty Perspectives on Occupational Health and Safety Training in Skilled Trades Education: Current Landscape, Gaps, Barriers, and Recommendations

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EXECUTIVE SUMMARY

Background and Objective

Canada is facing a significant shortage of skilled trades workers, with over 700,000 expected to retire by 2028. Ontario alone will need more than 100,000 skilled trades workers within the next decade. This shortage impacts various sectors, including construction, service, and manufacturing, limiting Canada's capacity to develop and maintain essential infrastructure and services. Work-related injuries are a major contributor to early retirement and the skills shortages, and skilled workers work in some of the highest risk-sector for workplace injuries. Not only do high rates of disability facilitate early retirement, but they also deter potential candidates from pursuing a career in the skilled trades.

Occupational health and safety (OHS) training is a critical component to injury prevention. However, knowledge and documentation of what OHS is taught and how OHS is integrated into Ontario's career technical education system are limited. This research explores instructors' and program coordinators' perspectives on 1) the OHS topics and content taught in skilled trades-related training programs and 2) delivery strategies for teaching OHS.

Methods

Semi-structured interviews were conducted with key informants within skilled trades education (i.e., program coordinators, professors, and instructors). Interviews were audio-recorded, transcribed, and analyzed using thematic analysis.

Key Findings

The Skilled Trades Ontario Curriculum Training Standards (STO-CTS) dictate the OHS topics taught in a program. They are the primary documents used in program development and review. They set program requirements and learning outcomes of apprenticeship programs, including their OHS components. The STO-CTS specify the time allotted for each unit within a program and are said to be regimented documents. Thus, the sufficient inclusion of OHS contents in the STO-CTS is paramount. Program review and development also considers input from instructors and industry partners (via program advisory committees). The valuable insights from instructors and industry partners help ensure the program offers relevant industry standards and best practices beyond the STO-CTS. However, OHS was rarely discussed proactively.

OHS content within a skilled trades program typically aims to provide students with a general awareness of the common hazards within the trade, OHS-related laws (i.e., OHS acts and regulations, worker and employer rights and responsibilities), safe work practices,

the realities of the workplace, and where to get OHS-related information. When asked if any OHS-related content should be added or enhanced in their program, key informants within the industrial, construction, and motive power sectors agreed that their programs covered all the necessary OHS topics except for mental health and wellness. On the contrary, key informants from service-related trades shared that much of the OHS-related content focuses on *client* safety (i.e., food safety, smart serve, and event emergency preparedness) instead of *worker* safety. Despite covering the essential OHS topics, key informants recommended enhancing the contents related to WHMIS, Working at Heights, and Ergonomics.

When asked *how* OHS was taught throughout the programs, key informants shared that most of the foundational content was taught during the first in-school semester (i.e., Level 1 of the apprenticeship program). OHS is first taught as a standalone course, in a unit within a course, or when introducing new materials, tools, equipment, or work processes. OHS content is then reviewed, repeated, reinforced, and built upon throughout the program.

Motivating students to take OHS seriously before an incident was a significant challenge. Key informants suggested that students often perceive OHS as irrelevant to their personal experience, considering themselves invulnerable or believing that 'that would never happen to me.' They discussed various OHS delivery methods while emphasizing that no single approach is universally effective in engaging students with OHS. Effective OHS delivery strategies that are currently used include engaging students with trade-specific examples, incorporating OHS into assessments, using interactive learning activities, providing experiential learning opportunities, and consistent reinforcement of safe work practices. Findings from this research will inform future strategies for enhancing OHS training in skilled trade training delivery agents.

Recommendations

- Update the STO-CTS to include the identified OHS content gaps (i.e., ergonomics and mental health).
- Increase and explicitly state the time that should be allotted to teaching OHS in the STO-CTS.
- Create and develop more trade-specific OHS resources.

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1. INTRODUCTION

The shortage of skilled trades workers poses a concern to the growth and development of Canada's economies and infrastructure. Over 700,000 skilled workers are expected to retire by 2028 (Employment and Social Development Canada, 2021); Ontario alone will need more than 100,000 skilled workers within the next decade to meet and keep pace with demands (Skilled Trades Ontario, 2023). Skilled trades workers, such as electricians, draftspersons, and chefs play a crucial role across several Canadian employment sectors, including the construction, service, and manufacturing sectors. The skilled worker shortage in the construction sector will limit Canada's capacity to develop and maintain essential infrastructure such as clean water systems, energy grids, transportation networks, and healthcare facilities (Canadian Construction Association, n.d.)

Work-related injuries are a major contributor to early retirement and the skills shortage. According to the Canadian Community Health Survey, trade-dominant sectors (e.g., trades, transport or equipment operator, primary industry processing, manufacturing, and utilities) accounted for over 25% of occupational incidents in 2014, making them the highest-risk sectors since 2001 (Nowrouzi-Kia et al., 2019). Given the context of the work, the high rates of injury and disability amongst tradespersons are not surprising. Skilled trades occupations expose workers to several ergonomic, chemical, and environmental hazards such as dust and fumes, repetitive movements, and noise (Boschman et al., 2012; dos Santos et al., 2017; Mekonnen, 2019). Not only do high rates of disability facilitate early retirement, they also deter potential candidates from pursuing a career in the skilled trades (Osuizugbo et al., 2023; Taylor et al., 2015). To better retain experienced skilled trades workers and attract young workers into the skilled trades, workers' health, safety, and wellness must be prioritized.

Occupational health and safety (OHS) training is a critical component to injury prevention. However, the effectiveness of OHS training depends on *how* and *what* OHS content is taught (Becker & Morawetz, 2004; Boini et al., 2017; Dong et al., 2004; Teufer et al., 2019; Williams et al., 2010). In Ontario, skilled trades workers typically receive their training, including aspects of safe work practices, via apprenticeship Training Delivery Agents (TDA). However, knowledge and documentation of *what* OHS is taught and *how* OHS is integrated into Ontario's career technical education system are limited. Thus, this research explores

instructors' and program coordinators' perspectives of OHS training in skilled trades education. Specifically, we explored program providers' perspectives on 1) the OHS topics and content taught in skilled trades-related training programs and 2) delivery strategies for teaching OHS.

By better understanding the current landscape of *what* and *how* OHS training is provided in Ontario's TDA and their gaps and barriers, we can identify the most effective and efficient strategies to improve OHS training within the skilled trades education system. This study was conducted in parallel with a gap analysis of the OHS training components of Ontario's apprenticeship and curriculum training standards (Somasundram et al., 2025), and a survey of skilled trades trainees' perspectives on OHS training. Findings from this research will inform future strategies for enhancing OHS training in skilled trade training delivery agents.

2. METHODS

We conducted semi-structured key informant interviews to address the research objective. Key informant interview is a qualitative methodology that is effective for quickly gathering relevant information and insights on a specific topic; it can be used as a standalone research method or in combination with other methodologies (Marshall, 1996). Typically, 12 to 17 interviews are required to reach data saturation (Francis et al., 2010; Guest et al., 2006). We analyzed the interviews using the thematic analysis approach set out by Braun and Clarke (2006) to identify, analyze, and report patterns in a structured and sequential manner (Braun & Clarke, 2006).

2.1 Study sample

We defined key informants as program coordinators, professors, and instructors who have taught OHS in any skilled trades program recognized by Skilled Trades Ontario (7). We used purposeful sampling to identify and recruit key informants for a 1-hour semi-structured interview. To facilitate a meaningful discussion, we shared the interview questions in advance to allow time for preparation and reflection. This study was approved by Conestoga College's Office of Research Ethics.

2.2 Data Collection and Analysis

We began each interview by providing the key informant with a brief overview of the research objective, the interview process, and protocols to ensure confidentiality. We also re-verified their consent to be audio recorded. The researcher moderated the discussion on OHS training in skilled trades education and ensured that all questions in the interview guide were covered. At the end of the interview, the key informants were given the opportunity to voice any additional thoughts on the topics discussed. The duration of the interviews ranged from 34 to 61 minutes.

Audio recordings of the interviews were transcribed verbatim using the advanced speech recognition software Temi (REV.com Inc., San Francisco, California, USA). The researcher reviewed each transcript for accuracy, removed identifiers, and sent the transcript to the participant to validate the accuracy of the transcript. At this point, participants were given another opportunity to make any additional comments or clarifications.

For analysis, transcripts were first deductively coded based on the two research topics explored (i.e., OHS content, OHS delivery methods). Additional overarching themes were developed when the topics did not fit into either research topic. Inductive coding was used to identify subthemes within each overarching theme. We selected quotes to illustrate the themes that emerged. Quotes were referenced using the skilled trade sector the key informant represented and a numerical ID (e.g., Construction_01).

3. RESULTS

In total, 13 key informants from nine different skilled trade programs participated (Table 1). There was balanced representation from the four major sectors in the skilled trades. We report on the themes and contents that emerged: 1) goals of OHS training, 2) OHS content taught, and 3) OHS delivery strategies (Figure 1).

Table 1. Description of the key informants interviewed.

ID	Post-secondary or Apprenticeship Program	Sector
1	Automotive Service Technician	Motive Power
2	Heavy Construction Equipment Operation	Construction
3	Industrial Mechanic Millwright	Industrial
4	Heavy Construction Equipment Operation	Construction
5	Carpentry and Renovation Technician	Construction
6	Events Management	Service
7	Automotive Service Technician	Motive Power
8	Culinary	Service
9	Culinary	Service
10	Tool & Die Maker / General Machinist / Machine Tool Builder & Integrator	Industrial
11	Heavy Duty Equipment Technician	Motive Power
12	Electrician	Construction
13	Industrial Mechanic Millwright	Industrial

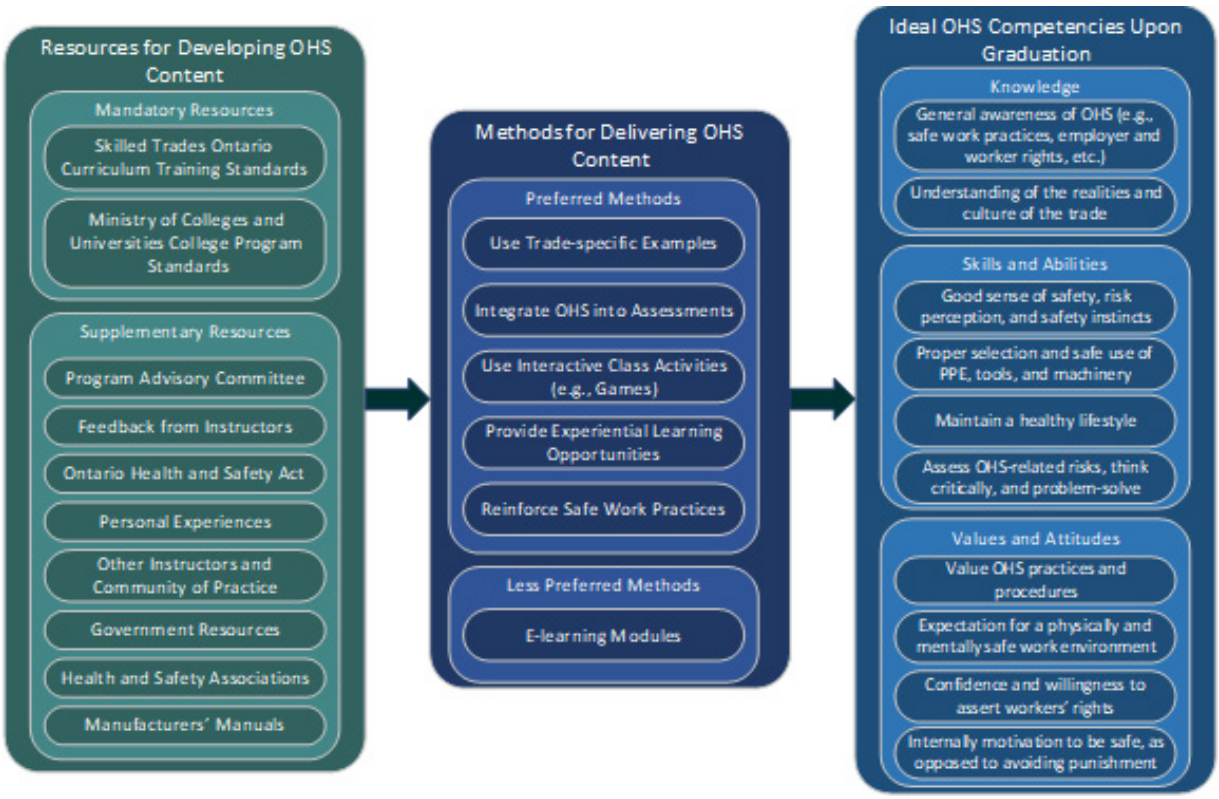

Figure 1. Overview of key findings.

3.1 Goals of OHS training

Ultimately, OHS training aims to develop the necessary knowledge, skills, and attitudes for trainees to conduct themselves safely in the workforce. Key informants described what they believed to the core competencies that skilled trade graduates should possess. They consistently emphasized that, upon completing a trades program, students should have a general understanding of safe work practices/procedures and the typical hazards and controls in their trade. The critical knowledge areas identified include an understanding of workers' and employers' rights and responsibilities, injury reporting processes, Workplace Hazardous Materials Information System (WHMIS), working at heights, confined spaces, trade-specific hazards and injury prevention strategies, ergonomics, shop safety, as well as the safe and proper use of tools, work processes, and personal protective equipment. Key informants also highlighted the importance of having a long-lasting healthy career, which requires awareness on preventing chronic injuries, diseases, and disorders. This includes conditions such as low back pain, hearing loss, and respiratory diseases, which develop over time due to cumulative exposures. Understanding the realities and cultural nuances of

the trade was another concept that key informants believed students should be aware of prior to entering the workforce.

Key informants also emphasized that students should have the skills to apply the theoretical OHS knowledge to work safely and foster a safe work environment. Essential skills include the ability to instinctively identify hazards, properly select and use PPE, tools, and machinery, maintain a healthy personal lifestyle, and think critically to address OHS hazards and unsafe work conditions.

Although students may be taught OHS-related knowledge and skills, key informants acknowledged that application of knowledge and skills in the workplace depends on the students' values and attitudes toward OHS. Key informants strived to cultivate a safety-first mindset among their students. Core values and attitudes included prioritization of OHS practices and procedures, expectation of a safe work environment (i.e., not settling with or conforming to hazardous work scenarios), confidence and willingness to assert workers' rights, and internal motivation to work safely. **Table 2** presents example quotes that support why these attitudes are essential.

Table 2. Example quotes pertaining to the core knowledge, skills, values and attitudes that students should have upon graduating from a skilled trades program.

Ideal Competencies	Example Quotes
Key Knowledge	
General awareness of OHS (e.g., safe work practices and associated hazards, employer and worker rights and responsibilities, etc.)	*You need to be aware of the risks and the dangers and most importantly, prevention of that.* – ***S ervice_08***
Understanding the realities and culture of the trade	*…One of the biggest compliments I get from students that have gone to work is that they tell me like, 'you know what, you didn't lie to me, like it happens. It's like that.'* - ***Motive Power_11***
Skills	
Good sense of safety, risk perception, and safety instincts	*Problem with any industry that's repetitive is that we do things sort of instinctively and therefore hazard awareness is more instinctive than, 'oh, let me go through my checklist and see if this is a hazard.' No, you just know it's a hazard and you instinctively react.* - ***Industrial_10***
Proper selection and safe use of PPE, tools, and machinery	*Proper use of tooling would be the obvious. You're not going to use a screwdriver as a pry bar. You're not going to use a wrench as a hammer because, as cliche as it sounds, using the correct tool for the job, it doesn't just go to work ethics and a level of professionalism, but it goes to safety as well. If you're beating on something with the wrong tool, 'Hey, it may slip. And if it slips, you skewer yourself or you damage the component, or you damage the vehicle.' So obviously, the correct tool for the job sounds pretty cliche, but that's a big part of it.* - ***Motive Power_09***
Maintain a healthy lifestyle	*… again, managing yourself is part of that too. I mean, we do tend to overwork, being overworked is part of the culture.* - ***Service_06***
Ability to assess OHS-related risk, think critically, and problem-solve	*… be able to point out here's a problem, we should probably deal with this, and to learn what is crucial and what's not.* - ***Construction_04***
Core values and attitudes	
Value OHS practices and procedures	*And what happens when people think differently of themselves. They think they are above a risk and assessment. That's when mistakes happen. 'Oh, I am strong. I've been doing this for years. I can go up a ladder and not have to tie myself down. I don't need somebody to double check me or having a three-point contact because I'm the tough guy.' Well, until you crack your skull, then what?* - ***Service_09***
Expectation for a physically and mentally safe work environment	*It's a little bit there where they think, 'oh, but that's my job to take that.' No, it's not. No one is paying you to have someone scream at you, and sort of whatever you want to say and berate you about your skills. You're there as a technician, you're not there as someone's punching bag.* - ***Motive Power_11***
Confidence and willingness to assert workers' rights	*For number one is that they have rights, another one is that it's okay to say no if you don't know. So removing the fear that the employers can force them to do something that is unsafe. And a lot of them feel that they don't really have anybody backing them up to refuse unsafe work.* - ***Service_09***
Internally motivation to be safe, as opposed to avoiding punishment	*This [injuries] is serious what it'll do to you, not what the fine will be, who cares what the fine is. I'm not concerned about a $200 fine for not wearing a hardhat. I'm concerned about whacking my head and bleeding all over the place. That's what I'm concerned about.* - ***Construction_04***

3.2 OHS Content Taught

3.2.1 Apprenticeship and Curriculum Training Standards

According to the key informants, the Skilled Trades Ontario Curriculum Training Standards (STO-CTS) dictate the OHS topics taught in a program. The STO-CTS are the primary resources used during program review and development. They set minimum program requirements and learning outcomes of apprenticeship programs, including their OHS components. The STO-CTS specify the time allotted for each unit within a program and are said to be regimented documents. A comprehensive gap analysis of the OHS contents found in the STO-CTS is presented in a series of reports (i.e., one per sector) as part of the STRIVE-OSH projects (Somasundram, 2025). Compliance with the STO-CTS is necessary for an apprenticeship program to be approved by the Ontario Ministry of Labour, Immigration, Training, and Skills Development (MLITSD) in order to become a provincially recognized TDA for the program.

Unlike apprenticeship programs, post-secondary skilled trade programs must comply with the College Program Standards set forth by the Ministry of Colleges and Universities (MCUCPS); however, key informants shared that many post-secondary skilled trade programs also voluntarily comply with the STO-CTS. If a post-secondary skilled trade program is aligned with the STO-CTS and becomes approved by MLITSD, completing the program offers students equivalencies that count towards the Certificate of Apprenticeship or Certificate of Qualification. Thus, the apprenticeship and post-secondary skill trade programs "actually mirror each other" because the STO-CTS plays a significant role in the content taught.

The sufficient inclusion of OHS contents in the STO-CTS becomes paramount given that the STO-CTS are the primary documents used for program development and review. However, several limitations of the STO-CTS were noted. First, adding new OHS content/topics or spending more time on an OHS topic was challenging because the duration dedicated to a unit or topic area is regimented in the STO-CTS. Key informants noted that, due to the large volume of content needed to be covered, OHS content/topics would be missed or inadequately taught if the STO-CTS does not explicitly state the OHS content or sufficiently allocate time to teach it. The following quote describes the challenges of teaching OHS when insufficient time is dedicated to it in the STO-CTS.

> *So this is the provincial apprenticeship curriculum, and this is level two curriculum and unit 1.3. So, repairers' rights and responsibilities. So, you know, describe the Occupational Health and Safety Act. So, but you're only describing it and touching on it. And if you look at the total hours, well, we've got four hours to talk about 6 sections. So we've got occupational health and safety, consumer protection, repair, and storage lien, Highway Traffic Act, workplace safety insurance, employment standards, and sorry, seven sections, Environmental Protection Act. So four hours to talk about seven sections. So there's not a whole lot of time spent talking about safety, orientation, or safety components inside the curriculum.* ***- Motive Power_07***

Key informants also brought up concerns about the datedness of the STO-CTS. Many STOCTS are over 10 years old; industry standards may have changed. Further, instructors mentioned that the onus for maintaining the STO-CTS has shifted multiple times, from MCU to the Ontario College of Trades to Skilled Trades Ontario. However, many of the standards have not been updated. The lack of time and the lack of explicitly stated OHS-related content within the STO-CTS has been a limiting factor to advancing skilled trade graduates' OSH-related knowledge, skills, and attitudes.

3.2.2 Supplementary OHS resources used in program and course development

Program review and development also considers input from instructors and industry partners (via program advisory committees). The valuable insights from instructors and industry partners help ensure the program offers relevant industry standards and best practices beyond the STO-CTS. OHS, however, was rarely discussed proactively. For example, **Industrial_10** shared, "Safety's a funny thing; it's not brought up until there's a problem in the sense of if there's an injury." Discussing a program's OHS content appears to take a reactive approach, motivated by the occurrence of an incident.

Instructors are encouraged to build upon course outlines with additional resources such as case studies and personal experiences to 'breathe life' into the course. Instructors may also review and update the past course material to reflect new legislation or industry processes. If the instructor believes the OHS content in the course textbook is inadequate, they may supplement it with additional resources. Common supplementary resources identified by the key informants included the Ontario Occupational Health and Safety Act (the Green Book), manufacturers' manual, health and safety associations (e.g., Infrastructure for Health and Safety Association, Workplace Safety and Prevention Services, and Public Services Health and Safety Association), government websites, personal experience, and consultation with the community of practice and other instructors (**Table 3**). Although there was limited oversight regarding the resources used, all key informants stressed the importance of using credible sources.

Table 3. Example quotes of supplementary resources that instructors and professors used to develop OHS content in addition to the course outlines, course shells, and course textbooks.

Supplemental Resources	Example quotes
The Ontario Health and Safety Act	*The Green Book is where we get our theoretical content augmented by our personal experience.* - ***Industrial_10***
Government Resources	*On occasion I will call the Ministry of Labour myself. The Ministry of Labour has people that will interpret things for you and tell you how the Ministry of Labour is handling certain things, including their website, but you can also speak to somebody directly.* - ***Construction_04***
Manufacturer's Manual	*I try to stick to manufacturers' websites. So if we're talking about something, when you're operating an excavator, then I'll use the words right out of the Caterpillar operator's manual.* - ***Construction_02***
Health and Safety Associations	*There was a site that I followed for a long time and got some material off them. The Canadian Center for Occupational Safety and Health. And so, I follow their content quite a bit.* - ***Industrial_10***
Personal Experiences	*It's my past as far as what I've done, and how I've done things. The experiences I've had, the experiences [name] had.* - ***Motive Power_11***
Other Instructors and Community of Practice	*I consult with the community of practice. So I speak with my coworkers, the professors, to get some input on some of the material that I planned to use.* - ***Motive Power_01***

3.2.3 Gaps in OHS-related Content

According to the key informants, OHS content within a program typically aims to provide students with a general awareness of the common hazards within the trade, OHS-related laws (i.e., OHS acts and regulations, worker and employer rights and responsibilities), safe work practices, the realities of the workplace, and where to get OHS-related information. When asked if any OHS-related content should be added or enhanced in their program, key informants within the industrial, construction, and motive power sectors agreed that their programs covered all the necessary OHS topics except for mental health and wellness. On the contrary, key informants from service-related trades shared that much of the OHS-related content focuses on *client* safety (i.e., food safety, smart serve, and event emergency preparedness) instead of *worker* safety. Despite covering the essential OHS topics, key informants recommended enhancing the contents related to WHMIS, Working at Heights, and Ergonomics. **Table 4** presents example quotes that expand on the OHS topics that should be added or enhanced.

Table 4. Example quotes pertaining to OHS topics that should be added to or enhanced in skilled trade-related programs.

Topics to add or enhance	Example quote
Mental Health	*I think that's an important part of ensuring that we have healthy and safe workplaces. So yeah, that'd be something else that is beyond an emerging topic now… that's probably where there's more resources needed.* - **Service_08**
Ergonomics	*Ergonomics is not a big focus. We don't get into it in that level. Other than it's up to the worker to protect themselves from that injury and know the risks and the hazards that are there. And if they're aware of the hazards, at least they would be able to bring that to their supervisor and say, 'yeah, me reaching up like this all day is not going to work,' and that kind of thing so it's more getting the students a little more informed than they might be, because a lot of our students come from like a zero background of industry, and it has to be started very basic.* - **Industrial_10**
WHMIS	*They're getting that general, you know, WHMIS rubber stamp. Whereas like I'm saying, they actually have a thing called WHMIS in Construction for a reason. So as an industry a little bit, yes, you got to take your regular WHMIS, but then you should also be more focused about the specifics of construction.* - **Construction_02**
Working at heights	*Would be a little bit more of the heights, we don't really teach much about working on heights because that's now been a kind of separate thing. So we don't go too deep into that.* - **Construction_02**

Even if more time and content for OHS were added, consistently delivering the content and reinforcing safe work practices between instructors were an overarching challenge. Oversight in program delivery is limited. The addition of OHS content needs to be accompanied by consistent content delivery by instructors who are proficient in the topics. Implementing standardized online courses is an existing strategy to ensure consistent delivery. However, e-learning has several limitations that we will discuss further in the report.

3.3 OSH Delivery Strategies

When asked how OHS was taught throughout the programs, key informants shared that most of the foundational content is taught during the first in-school semester (i.e., Level 1 of the apprenticeship program). Depending on the program or OHS topic, OHS is first taught as a standalone course, in a unit within a course, or when introducing new materials, tools, equipment, or work processes. OHS content is then reviewed, repeated, reinforced, and built upon throughout the program.

Interviewees asserted that this teaching structure was crucial for knowledge retention and understanding the application of OHS concepts in various scenarios. Key informants shared that, aside from non-skilled trade-related courses (e.g., English and Math), OHS-related content naturally embeds itself throughout the program. **Motor Power_10** shared an example:

> *Most instructors would introduce health and safety opportunities in any lesson as they're going along. So whether we're talking about an engine subject, or we're talking about a cooling system, well, 'Hey, if you remove that radiator cap and there's 15 and a half pounds of pressure in the system, you're going to scald yourself because it's going to be well in excess of a hundred degrees Celsius.' …And so, any opportunity we get to introduce safety somewhere, I think it's a natural by-product of us teaching and having come out of the trade.*

Key informants also shared that OHS foundations are increasingly delivered in standalone online modules. The intention is for students to complete the e-module before entering the

shop. Then, instructors review and reinforce the OHS concepts in the practical labs. However, due to the online delivery of the OHS content, key informants felt that there were now fewer opportunities (i.e., less time) for instructors to teach OHS and make it engaging. They also perceived the online modules as 'mundane,' 'generic,' and a waste of time. For example, **Service_06 shared,** "*So we talk a lot about how important it is for training and how important it is to train in situ. Because that's the challenge, we send all our students off to take these courses online!*" Key informants suggested using more engaging activities in the e-learning modules, such as simulations and virtual reality.

Motivating students to take OHS seriously before an incident was a significant challenge. Key informants suggested that students often perceive OHS as irrelevant to their personal experience, considering themselves invulnerable or believing that 'that would never happen to me.' They discussed various OHS delivery methods while emphasizing that no single approach is universally effective in engaging students with OHS. Noteworthy, the overarching approach involved presenting textbook material and best practices first and then discussing the application of these concepts in real-world settings. We present the delivery strategies used by key informants to make OHS engaging (**Table 7)**.

Table 5. Summary overview of concepts identified related to delivery methods

Delivery method	Rationale/benefits	Examples of use cases	Resources used	Barriers to implementation
Use trade-specific examples	- Connects OHS content with the affective domain for students to see the value of OHS - Makes it more relatable to the students - Helps students to better understand how general theories taught are put into practice	- Use of graphic media and occupational hazards - Having students share stories - Sharing personal experience - Inviting guest speakers to talk about their experiences with work-related injuries and work refusals - Examples of correct and incorrect techniques	- Case law, case studies, graphics, and videos of injuries (e.g., YouTube, government websites, news stories) - Testimonies from those who have been injured (e.g., WSIB videos) - Guest speakers (e.g., alumni, current skilled trade professional) - Personal experience	- Can become less effective than hands-on because student can get desensitized to it - May traumatize students - Examples in online safety teaching modules are too general and not relevant to specific skilled trade - Instructors may have different levels of experiences
Integrate OHS into assessments	- Increases students' incentive to behave safely and pay attention in class when OHS is being taught because they know their grades will be affected	- Marks are deducted if students do not follow appropriate safety protocols - A safety component is embedded in assignments	- Pre-existing course outlines - Assessment rubrics	- Part-time instructors tend to pass everyone; they don't have incentive to fail students - Cannot truly verify learning outcomes from online courses - Creates compliance but does not inspire internal motivation and continuous improvement
Use interactive class activities	- Helps to keep students engaged and involved in learning the OHS content	- Gamification of OHS content - Hazards control/identification activities - Search WSIB for injury rates within their trade - Have students teach material to each other - Have students look up answers to specific safety practices in legislation	- The Green book - Manufacturers' manuals - VR and simulations	- Many OHS content has been shifted online which is not interactive

Table 7. (cont.)

Delivery method	Rationale/benefits	Examples of use cases	Resources used	Barriers to implementation
Provide experiential learning opportunities	- Experiential is more memorable - Allows students to learn from experience	- Real-life demonstrations - Use the same equipment that employers use - Have students perform the procedures and safety inspections - Live events (events planning) - Real-life tour of a work environment to identify and understand the hazards - Invite someone in the field to demonstrate a task - Allowing students to make mistakes and then correcting them	- Use of real equipment and tools as examples for hands-on experience	- Teaching online makes it difficult to demonstrate in-person - Not enough time and/or money to simulate everything - Need the necessary prop to demonstrate safety practices. - Doing the tasks, but safety is not highlighted - Overseeing 30 students performing tasks may be challenging
Reinforce safe work practices	- Helps students develop a better sense to safety culture, and less tolerance for unsafe work - Demonstrates prioritization for OHS - Students will follow rules when they know the instructor is strict and reinforces the rules - Promotes students to ask questions to understand *why* things are done a certain way - Can help to set the tone that safety needs to be set as a priority and taken seriously	- Instructor leads by example - Constantly reinforcing OHS, taking it seriously in the shop, and not letting any malpractice slide - Stop class when there is a learning opportunity - Zero tolerance for unsafe practices - Provide rewards and positive reinforcement for working safely - Stopping class to do a mid-class cleanup - Safety violations are reported and coordinated with other professors - Safety logs - Treating students with respect, as they were employed workers	- Instructors that embody OHS, values OHS, and emphasizes the importance of OHS	- Building a consistent safety culture among all instructors - Larger class sizes make it more difficult to keep an eye on everyone - Lack of demonstrated institutional commitment to safety and ensuring that equipment is safe - Shift to online lectures eliminated one-on-one safety reinforcements - Consistency of instructors' and their approach to OHS

3.3.1 Use trade-specific examples

Key informants concurred that sharing trade-specific examples was an effective method for teaching OHS. These examples fulfilled multiple functions. First, they enhance students' and apprentices' comprehension of the relevant OHS principles by linking theoretical content to practical trade realities. Second, case examples of OHS-related incidents in the trades facilitate a deeper understanding of the causal factors and the preventative measures that can be proactively employed. Lastly, perhaps most critically, these examples underscore that workplace incidents happen, dispelling the notion of invulnerability among trainees. A key informant in the service sector explains:

> *It's really about stories from experience, tragic situations that have occurred and asking students too what they've seen, if they've ever seen an issue with somebody being injured in the workplace. Ever gotten hurt? How? What happened? How can we learn from those situations? I usually try to tell a few stories without trying to traumatize anybody about things that have happened. So I try to tell those kinds of stories or use cases to sort of unpack the idea of who's responsible, and who's liable, and what kind of diligence is required to prevent those kinds of situations.*
>
> ***- Service_08***

Trade-specific examples can come from the personal experiences of instructors, apprentices, alums, and guest lecturers. They also include case studies in the news and courseware and images or videos of safe and unsafe work environments and practices. Further, key informants noted the importance of ensuring students understand the seriousness of workplace incidents while not traumatizing them from the trade. Instructors may additionally use examples, such as caselaw, to demonstrate the legal consequences of workplace incidents for those involved.

A barrier to using trade-specific examples is the lack of relevant examples available. Instructors who have little experience working in the trade are particularly affected. Although they may understand how the work '*should*' be done, they have fewer relevant hazardous work stories, limited knowledge of the trade culture, or how the work is '*actually*' done in the industry. In addition, instructors asserted that the lack of trade-specific

examples in generic online OHS training courses/modules contributed to poor engagement and knowledge retention. They suggested developing more trade-specific OHS content.

3.3.2 Integrate OHS into assessments

Including OHS components in assessments was another strategy instructors used to motivate students to take OHS seriously. Instructors integrated OHS-related elements into course outlines and assignment rubrics for theoretical and practical courses where applicable. For example, instructors may include OHS-related content in quizzes and assignments for theoretical courses, including online courses. For practical courses, instructors may deduct marks for unsafe work practices. One interviewee explains:

> *We have a safety mark and a professionalism mark that we take away depending on the type of infraction. So if they show up to shop class with no safety glasses, they can lose a mark for that.* ***- Construction_02***

Key informants shared that students were more motivated to behave safely and pay attention during OHS lectures when they knew they were assessed on it. Key informants believed that many students cared about their grades, sometimes more so than how the OHS content would apply to them in the field.

Although OHS-related knowledge and skills are already included in assessments, it is noteworthy to discuss the barriers and challenges of the evaluation process. Key informants criticized how students' OHS knowledge was evaluated, especially in online courses, stating that they are superficial and do not meet the knowledge requirements to work safely in the field. Further, key informants expressed that students do not retain the information taught online. Challenges and barriers to assessing OHS practices also exist in practical labs. Most instructors had '*no real incentive to penalize a student from breaking a rule if that's going to affect him [the student] from passing the course since students passing the course affects his [the instructor's] performance.*' As a result, students often received perfect safety marks unless a serious infraction occurred (i.e., not wearing PPE). Students had little incentive to go above and beyond minimum safety requirements. Including components of OHS in assessments may incentivize students to *comply* with safety practices but may not help them develop intrinsic motivation to take further safety precautions.

3.3.3 Use interactive class activities

In addition to traditional class lectures, instructors used numerous class activities to engage trainees and create dialogue. Examples of engaging class activities included answering specific legislative OHS-related questions by perusing the Green Book and researching common injuries in the trade via the WSIB website. Gamifying the delivery of OHS content (e.g., Kahoot Trivia, Jeopardy, iSpy for hazard awareness, and broken telephone) was another example used to keep students engaged.

3.3.4 Provide experiential learning opportunities

Key informants consistently reiterated the value of experiential learning and live demonstrations for teaching OHS. According to our key informants, those pursuing a skilled trade are typically visual and hands-on learners; thus, experiential learning and live demonstrations are vital to solidifying theoretical OHS knowledge amongst this population. Key informants suggested that experiential learning is effective because it allows trainees to make mistakes and learn from them in a safe environment. A key informant described the effectiveness of experiential learning:

> *Regardless of how many times I would have said that to the student in the past until they experienced that… It's just that experience just brings out so much stronger learning.* ***- Motive Power_01***

Experiential learning should be accompanied by timely feedback. One key informant did this by monitoring trainees' work habits and behaviours during hands-on assignments and practical labs, then pausing the class to reinforce positive work habits and discuss teachable moments. The key informant would provide specific examples without shaming or identifying anyone.

In addition to the practical labs and assignments inherent to all skilled trade programs, key informants shared other forms of experiential learning and live demonstrations. One key informant described how he invited the local fire department to teach fire safety and allow trainees to use real fire extinguishers to put out fires. The event also included live demonstrations of the consequences of applying inappropriate fire suppression methods to various types of fires (e.g., using water on oil fires). Another would bring field equipment into the classroom for students to try. Further, some courses included working in the field with

real-life implications; examples include cooking for an event or constructing something for/within the local community.

Although the benefits of experiential learning and live demonstrations are clear, its implementation has several barriers and challenges. Perhaps the most obvious is that acquiring the equipment for hands-on learning can be expensive, and many hazardous scenarios cannot and *should not* be replicated/simulated. Supervising a class during practical assignments or hands-on training is also a challenge for implementing experiential learning. One key informant described their experience supervisor a class of 20:

> *When you have 20 students, and they're all on pieces of equipment and stuff… it's a nerve-wracking experience when you know these are all new students and they don't have that repetitious (sic) of the safety yet. And so, I just come home frazzled some nights and it's just like, 'oh my God, I'm just so happy, got through it, thank God.'* ***- Construction_02***

Given the stress of supervising students, some instructors might not allow hands-on experiences altogether because they do not trust their students to perform tasks safely. Some key informants suggested immersive virtual reality technologies as a potential strategy to enable students to have hands-on experiences in a safe environment. Virtual reality technologies can help trainees understand the consequences of unsafe work practices and internalize the importance of following safety protocols in a safe virtual environment.

3.3.5 Reinforce safe work practices

According to our key informants, consistent reinforcement of safe work practices is critical in developing the appropriate values and attitudes towards OHS (as identified in section 3.1 Goals of OHS Training). It also helps create a mentally and physically safe work environment. In practice, instructors would identify and correct unsafe behaviours to prevent the development of bad habits and highlight the importance of safe work practices. The following quote describes how instructors reinforced OHS practices:

> *It's very repetitious of every day drilling it back in, like you know, the PPE has gotta be mandatory, whether we're out on the field or we're in the shop. If you start letting things slide, then it becomes, 'well, I thought it*

> *wasn't a mandatory type thing.' So we really keep on it every day, every single day… I mean as soon as you see something, don't allow it, just get right on it.* - ***Construction_02***

Key informants shared that consistent reinforcement requires instructors who are passionate about OHS and lead by example. **Service_06** describes, "*It really depends on how you teach it as well, because you need to be passionate, and you need to show that it's serious*." As an outcome of consistent reinforcement, "*after a while, students will correct each other*." Consistent reinforcement and delivery of OHS require participation from all instructors.

4. DISCUSSION

Effective OHS training will be a critical component in building and maintaining the capacity for the skilled trades workforce. Although employers ultimately bear the responsibility to provide workers with OHS training (Occupational Health and Safety Act, R.S.O. 1990, c. O.1, 2024), TDA also has a critical role in ensuring that trainees graduate with the necessary OHS competencies to work safely (Bush et al., 2019; Rauscher et al., 2021). In fact, sometimes, the TDA is the only place where trainees will receive OHS training (Bush et al., 2019; Rauscher et al., 2021). Our findings generated a list of key knowledge, skills, and attitudes that faculty members aimed to embed in their trainees upon graduation. Many of the core competencies are aligned with the OSHA 10/30 in the United States (Bush et al., n.d., 2019; Stanley, n.d.). Faculty members had an overarching goal to ensure that trainees took OSH policies and practices seriously before an incident occurred. We discuss potential strategies and solutions to address gaps and barriers that will enable instructors to effectively teach OSH.

First, the STO-CTS should be updated to include the identified OHS content gaps (i.e., Ergonomics and Mental Health). Our key informants felt including these topics in the curriculum training standards would better reflect the needs of the industry. For example, work-related musculoskeletal disorders (WR-MSD) are an outcome of poor ergonomics. WR-MSD are among the leading causes of disability and early retirement in the skilled trades (Welch et al., 2010). In fact, MSD accounts for 45-60% of disability retirements of the aging workforce (i.e., +50) and about 10% of construction workers do not return to the profession after an acute MSD injury (Welch et al., 2010). As a result of OHS content gaps in the curriculum standards, faculty members would integrate the topics into the lesson plans whenever possible. However, this approach is inconsistent between instructors, and worse, it may be excluded altogether. The inclusion of mental health and Ergonomics into the STOCTS would ensure that these topics are taught and support the reduction of early workforce exit in the skilled trades.

Second, the time dedicated to teaching OHS should be increased and explicitly stated in the STO-CTS. Faculty members felt restricted by how much time they could spend on OHS training given the rigidity of the STO-CTS: high volume of content and not enough time explicitly dedicated to OSH training. A study that evaluated a series of pre-developed OHS materials (i.e., slide decks, assessments, and outlines) for skilled trade course instructors

concluded that formalizing time to teach OHS in the curriculum was needed (Bejan et al., 2020). Even though the instructors had all the OHS training materials prepared for them, they did not have time to use them! Explicitly setting time aside to teach OHS would set a precedence for OSH. Otherwise, the time for OSH training will continue to be in competition with other course material.

Third, there is a demand for trade-specific OHS resources. Faculty members shared the need for more trade-specific OHS resources, including slide decks, lesson plans, and other forms of media. They found the existing materials to be generic and ineffective, especially the online training modules, which are increasingly prevalent (Rohlman et al., 2016). Trade-specific resources would support students in understanding how OHS content applies to their careers (Zierold, 2016). As an example, WorkSafeBC has developed a series of OHS-related videos for various trades and OHS topics (WorkSafeBC, n.d.). Instructors have shared multiple ways they aim to provide relevant examples, such as personal experiences and inviting guest speakers; however, the availability of relevant content through different mediums would help to accommodate a diverse range of learning styles.

Although key informants were not supportive of delivering OHS training through online modules because they found it to be ineffective and took time away from teaching OHS in class, they were supportive of other forms of technologies, such as immersive virtual reality and simulations. These technologies immerse the trainee into the work environment and allow them to experience the consequences of their actions and decisions (Sacks et al., 2013; Thomas & Brown, 2009). Teaching styles that emotionally engage with the student are effective in creating behavioural changes (Bhandari et al., 2019). Studies found that trainees learn better when they are required to participate in interactive problem-solving and decision-making (Sacks et al., 2013). Most of these technologies show safety hazards with acute outcomes (electrocution, crashes, fires, falls, etc.) and do not demonstrate chronic injuries and illnesses like MSDs (Bhandari et al., 2019). Typically, these technologies are trade- and task-specific, making the experience relevant for the trainee. The use of VR for OHS training is already available and in use for training the safe use of mobile elevated platforms, welding, spray painting, heavy-duty equipment operation and more. Immersive learning technologies are an area worth further investigation.

Many of the suggestions are beyond the roles and responsibilities of our key informants. It is clear that a multi-pronged systems approach is required to effectively support faculty

members in what and how they teach OHS. The strategies and solutions listed above aim to address overarching and systemic barriers. They act at various levels within the educational system, from curriculum standards to resources that support effective OHS delivery. The literature reaffirms that, in order to generate long-lasting changes in safe work practices, OHS training must be considered and integrated at various levels of the education system (Bush et al., 2019; Chatigny, 2022). Findings from this research will inform future strategies for enhancing OHS training in skilled trade education.

5. CONCLUSION

In this research, we interviewed thirteen key informants on what and how OHS training is provided in skilled trades education. All had experience teaching OHS in a skilled trade-related program, either in an apprenticeship or post-secondary program. The interviews helped us better understand the current landscape, barriers, and possible solutions related to what and how OHS content is taught in TDA. Additionally, we identified core competencies that should be integrated and particular OHS topics are underrepresented in curricula (e.g., mental health and ergonomics). There is a desire to provide OHS training throughout the program to improve knowledge retention, but it may be limited to the rigidity of curriculum standards. It is presumed that OHS training is delivered by employers; however, faculty intimated that apprentices with job experience enter formal training programs ill-prepared to preserve their own health and safety. We also examined effective delivery methods, but there was no recognized "one-size-fits-all" approach; delivery of OHS content should consider the diverse learning styles of trainees, students, and apprentices. Effective training may be characterized as trade-specific, engaging, and incorporating experiential learning paradigms. Potential strategies and solutions to address overarching barriers and advance effective delivery of OHS were discussed. Ultimately, findings from this research will inform future strategies for enhancing OHS training in skilled trade education and building capacity to address the skills shortage.

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