



Situated Learning: How Interactions with Supervisors Shape Construction Apprentices' Safety Learning and Practice

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Abstract: This paper presents the results of the first stage of a research project focused upon supervisor–apprentice communication in the construction industry and the influence that this communication has on apprentices' health, safety, and wellbeing. In-depth interviews were conducted with 30 apprentices and 11 supervisors in the Australian construction industry. Interviews explored the quality and nature of supervisor–apprentice communication. The data was analyzed using an inductive and iterative process of reading, coding, and reflection. The results show that apprentice–supervisor interactions play an important role in what is learned and, ultimately, how safety is enacted. Previous research has identified the frequency and quantity of supervisor communication as important for safety in the construction industry. However, The findings of the present study extend this work to provide qualitative insights into the role played by supervisors' safety-related communication in determining: (1) what is learned about safety and risk by inexperienced workers during their on-the-job training; and (2) how work is performed in ways that reflect varying degrees of risk acceptance among apprentices. The qualitative data provide rich and nuanced information regarding the dynamic interactions that take place between apprentices and supervisors within the material environment of the construction site. The results suggest that providing classroom-based safety training to apprentices may be insufficient to ensure safety learning in practice. Rather, effective safety learning programs for apprentices need to consider the social context of the workplace and ensure that supervisor–apprentice communication is supportive of positive safety learning outcomes and behaviors. DOI: [10.1061/\(ASCE\)CO.1943-7862.0002371](https://doi.org/10.1061/(ASCE)CO.1943-7862.0002371). © 2022 American Society of Civil Engineers.

Introduction

Apprenticeships and On-the-Job Learning

For many young people, apprenticeships provide an important pathway to transition from school to full-time work (Bednarz 2014; Couldrey and Loveder 2016). Apprentices acquire occupational skills and values that denote membership and status in a trade through their participation in on-the-job learning (Marchand 2008; Fisher 1986). Learning how to deal with safety and risk at work

forms an important part of this occupational socialization (Gherardi et al. 1998b; Grytnes et al. 2021).

Apprentices engage in both classroom and “on-the-job” learning (Buchanan et al. 2016). This includes learning about technical aspects of safety in the classroom. However, classroom learning about safety does not automatically lead to the application of what has been learned in the workplace (Grytnes et al. 2018) and, therefore, a disconnect between “idealized” safety and workplace practice can exist (Grytnes et al. 2021). A gap between work as imagined and work as done is known to exist in many workplaces. However, for apprentices who are still developing an understanding of normative ways of working, the distinction between idealized and actual safety practice is likely to be particularly salient.

Effective communication plays a key part in on-the-job learning (Lopata et al. 2015) and positive interactions between apprentices and supervisors are instrumental in protecting apprentices' safety at work (Einboden et al. 2021; Bednarz 2014). More experienced workers, particularly supervisors, play an important role in facilitating apprentices' workplace learning (including in relation to safety) through imitation and role-modeling (Chan 2017).

Young Workers' Experiences of Work-Related Safety

Young workers (frequently defined as workers under the age of 25) experience a disproportionately high incidence of work-related accidents and injuries compared to older workers (Breslin and Smith 2005; EU-OSHA 2006; Turner et al. 2015; Loudoun 2010). In Australia, young workers experience a rate of injury that is 18% higher than that of workers aged 25 years and over (Safe Work Australia 2013). European data indicates that construction has a higher rate of fatal accidents among young workers than all other industries (except agriculture) and accounts for the highest number

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of occupational fatalities in workers aged below 25 years (EU-OSHA 2007). In Australia, the construction industry recorded the highest number of young workers who died from a work-related traumatic injury between 2008 and 2011 (Safe Work Australia 2013).

Factors Contributing to Young Workers' Safety Experiences

Young workers' high incidence of workplace accidents is sometimes attributed to risk factors associated with youth, including body size, sleep requirements, musculoskeletal and endocrinal development, and cognitive and emotional maturity (Okun et al. 2016). Adolescent risk-taking and a sense of invincibility have also been identified as contributory factors to accidental injury among young workers (Steinberg 2004). Importantly, these explanations fail to consider sociomaterial characteristics of the workplace that shape young workers' experiences of risk and safety (Nielsen 2012).

Assumptions about causal relationships between immaturity and safety are not well supported by research evidence (Karlsson 2014). For example, after controlling for occupation and self-reported physical exertion, Breslin and Smith (2005) found that young adults (aged 20–24) had higher odds of experiencing work-related injury than adolescents (aged 15–19), which is inconsistent with arguments that being young is the primary risk factor for workplace injury.

Breslin et al. (2007a) also found that young workers' injury experience is more strongly associated with the type of work being performed than with biological age. Young workers are frequently exposed to dangerous work conditions, including exposure to asbestos without appropriate protective equipment (McCormack et al. 2013). Holding other factors constant, Australian workers aged between 15 and 24 are reported to be exposed to 30% more workplace hazards and to multiple hazards simultaneously (including noise and vibration, and chemical and airborne hazards) compared to workers aged 55 or over (Safe Work Australia 2015). Young workers' elevated injury rates have also been linked to requirements to work too fast for their skill level, being provided with damaged equipment, inadequate training/supervision, and having limited control over the way work is done (Okun et al. 2016). Long and nonstandard work hours (particularly night shift work) are also linked to young workers' experience of injury, both generally and specifically in the Australian construction industry (Breslin et al. 2007a; Loudoun 2010).

Social interactions between young workers and others, including supervisors and coworkers, shape their risk-taking behavior through the development of normative beliefs about how work should be done (Pek et al. 2017) as young workers are observed to adapt to what is considered to be a "normal" or acceptable level of risk in a particular work context (Nielsen 2012).

Inexperience, Safety, and Age

It is important to note that not all apprentices are young and increasing numbers of mature age workers are taking up apprenticeships. For example, as of 2016, adult apprentices (aged 25–64 years) made up 28% of trade apprentices in Australia, compared with 8% in 1996 (NCVER 2021). This is important because, in addition to age, inexperience is frequently identified as a risk factor for workplace injury. For example, Breslin and Smith (2006) report workers in their first month of a job to have four to six times higher rates of injury (reflected in compensation claims) than those with more than 1 year on the job. Importantly, being new to a job was a risk factor

for injury irrespective of age (Breslin and Smith 2006). A systematic review of published studies examining the relationship between job tenure and work-related injury found a significantly elevated risk of injury among new workers (defined as having spent 12 months or less in their job) in four out of six studies analysed (Breslin et al. 2019). The high risk of injury among inexperienced workers has been attributed to a number of factors including: being unfamiliar with work tasks, being unsure how to deal with unexpected events, having difficulty recognizing and appraising hazards, being exposed to hazardous conditions, being allocated more hazardous work, and being less knowledgeable about workplace safety policies and protections (Breslin et al. 2019).

Importantly, Canadian research suggests that inexperienced mature workers (aged 25+) have a higher rate of injury than inexperienced young workers (aged 15–24 years old) and new male workers are also more susceptible to injury than new female workers (Morassaei et al. 2013). Potential reasons for this include the possibility that older workers have more difficulty adapting to new situations than younger workers or that they may be given more dangerous work tasks in the belief that they are more mature or have previous work experience (Morassaei et al. 2013).

These findings suggest that it is important to understand the safety learning experiences of apprentices irrespective of their age.

Safety Initiatives Targeting Young and Inexperienced Workers

Safety training initiatives targeting young and inexperienced workers, such as apprentices, often seek to change workers' safety-related attitudes and behavior (Grytnes et al. 2021). However, rarely do such safety initiatives seek to change features of the social or material work environment that contribute to young and inexperienced workers' risk-taking behavior (Labege et al. 2014).

The underlying premise of "information-giving" initiatives is that young and inexperienced workers' unsafe behavior is caused by immaturity, poor judgment and risk-taking (Nykanen et al. 2018). However, young and inexperienced workers have been found to understand the risks that they face but perceive that they have little power to reduce these risks (Breslin et al. 2007b). In particular, research shows that young workers are often reluctant to raise safety concerns with their supervisors (Tucker and Turner 2013; Turner et al. 2015) and, even when they do, their concerns are "systematically silenced" by supervisors who fail to listen or act (Breslin et al. 2007b). Zierold (2017) similarly reports that young workers whose supervisors are unapproachable and unwilling to engage in safety-related conversations are more than twice as likely to perform dangerous tasks than young workers who feel that they can talk openly about safety with their supervisors.

Improving supervisors' communication skills is also important for the safety of inexperienced workers. For example, Kaskutas et al. (2013) report that inexperienced construction workers in the residential sector are exposed to fall hazards for which they are unprepared. A program combining technical falls prevention training with communication skills was delivered to supervisors of inexperienced workers and found to significantly improve the safety-related behavior of residential workers in the United States (Kaskutas et al. 2016). In order to fully utilize the opportunity to positively influence safety through supervisor communication, it is useful to better understand the characteristics of supervisors' communication that are supportive of effective safety learning and positive safety behavior.

Research Aim

Previous research has demonstrated the importance of supervisors' communication behavior in shaping the safety climate and performance of construction workgroups (Hardison et al. 2014; Alsamadani et al. 2013; Fang et al. 2015; Lingard et al. 2019). This previous work used quantitative methods to understand the link between the frequency and/or medium of communication and workplace safety practices. The present paper extends the understanding of the role and importance of supervisor communication by analyzing qualitative data collected in the Australian construction industry to examine, in greater depth, the way that interactions between supervisors and apprentices contribute to the establishment of normative practices and expectations about behavior in relation to safety risk in the work context. The paper aims to develop an understanding of the way that interactions between supervisors and apprentices establish and reinforce ways of "doing safety" in the construction site environment, reflecting aspects of the physical and material context within which work is performed. The qualitative analysis extends previous research that has demonstrated the importance of frequent safety-related communication between supervisors and workers by exploring in depth the nature and the substance of conversations that shape apprentices' safety learning and behaviors.

The importance of this work lies in the fact that apprentices are engaged in a formative experience of learning what it means to be a skilled tradesperson and, therefore, their experiences during this time are likely to have a lasting effect on their understanding of how safety should be practiced. Young and inexperienced workers are also a particularly vulnerable groups for workplace injury.

The analysis draws on the concept of situated learning of safety, which is briefly described before the research methods are described, and the results of the analysis are presented and discussed.

Situated Learning and Safety

Safety is often seen as a characteristic of technical systems that can be measured and managed through formal systems for risk quantification and control (Gherardi and Nicolini 2000). However, an alternative way to understand safety is as a "situated, negotiated, generated, and transplanted" feature of work that is embedded in the historical, sociomaterial, and cultural context of the workplace (Turner and Gray 2009, p. 1260). According to Gherardi and Nicolini (2002) safety is "a doing" arising through interactions between people and technologies that operate within a system of social relations (p. 192). For example, Ozmec et al. (2015) describe how standardized rule-based approaches to safety inform the way that workers in the construction industry "take care of themselves." However, behaviors in relation to safety often involve workers' own personal feelings and consideration of the need to balance safety against multiple objectives (e.g., cost, time, customer service, etc.) Ultimately, safety practices are shaped by supervisor/employers' expectations, reflected in the way that safety is communicated, and individual workers' self-determined ways of working (Ozmec et al. 2015). Previous ethnographic research in highrise steel erection work suggests that, in some cases, these ways of working involve not acknowledging or showing fear in order to fulfil social expectations of being a reliable and safe worker (Haas 1977).

Within the workplace, situated learning describes the process through which novice workers engage in "ongoing social activity aimed at discovering what is to be done, when and how to do it according to specific routines and using specific artefacts, and how to give a reasonable account of why it is done and what sort of person one must become in order to be a competent member of that community" (Gherardi et al. 1998a, p. 277). Thus, learning

about safety reflects "knowing how to behave as a competent member in a culture of safety practices" (Gherardi and Nicolini 2000, p. 9). Learning on-the-job occurs when newcomers participate with others in shared activities within the workplace (Gherardi et al. 1998a). Through the "doing" of work, technical knowledge (about how to do a job) and sociocultural competence (including relational/interpersonal skills) are learned (Holmes and Woodhams 2013). Learning occurs through observation, emulation, and physical work, which are closely intertwined with verbal and nonverbal communication (Gherardi and Nicolini 2002). Social interaction is therefore the principal means through which the habits and traditions of a community become part of the learner's sense of self or identity (Gherardi et al. 1998a).

Methods

Data Collection

Semistructured interviews with 30 apprentices and 11 supervisors were conducted in the construction industry of New South Wales, Australia. The interviews explored the ways that supervisors and apprentices talk about life, health, and safety, the nature of supervisor–apprentice communication about these topics and the characteristics of supportive interaction. The interviews were exploratory and used open-ended questions to elicit participants' reflections, opinions, and personal experiences. An interview guide was followed to provide reliable, comparable data. The data collection and management protocols were approved by the lead author's university Human Research Ethics Committee (Conversations about life, health and safety: Social supports for young construction workers' safety and wellbeing: Project number: 2020-23303-11072). Apprentices were contacted directly by the research team and participation in the study was voluntary. Interviews were conducted and recorded outside work hours and transcribed verbatim using a commercial transcription service. Transcripts were de-identified and apprentices are referred to by pseudonyms.

This paper reports findings in relation to interactions focused on workplace safety. During the interviews, apprentices were asked: (1) what happens if they see or experience something unsafe on site (e.g., who do they tell and what action would be taken as a result?); (2) whether they have had any close calls in relation to safety and, if so, what happened; and (3) how their supervisor teaches them about safety on site (e.g., what do supervisors say and do to ensure apprentice safety and learning?). Supervisors were asked: (1) to think of an example when something unsafe happened on site involving an apprentice and recall how they (as a supervisor) dealt with it; (2) what they do if an apprentice comes to them about something unsafe on the site (e.g., what usually happens?); and (3) whether they think that they have sufficient resources (training, time, equipment, etc.) to support their apprentices to work safely in their current worksite environment.

Interviews were flexible, in that they allowed the interviewer to probe and follow leads raised by participants. Due to travel restrictions related to COVID-19, interviews were conducted over the phone, or via video, depending on the participant's preference, and audio recorded. Apprentice interviews lasted between 30 and 60 min. Interviews with supervisors lasted 40 to 90 min.

Recruitment and Sampling

Apprentice and supervisor participants were recruited in partnership with the Master Builders Association of New South Wales (MBA-NSW). An initial recruitment message was circulated by the MBA-NSW to the cohort of apprentices registered with the

MBA-NSW Group Training Organisation via an email calling for apprentice participants. When this failed to generate volunteers, the email was circulated with an incentive (\$50 gift voucher). Apprentices who expressed an interest in participating in the study were contacted by phone. Participants were completing electrical, carpentry and joinery, and plumbing apprenticeships, and were employed in the residential and/or commercial building sectors of the construction industry. The MBA-NSW also provided researchers with a list of 18 supervisors. People who give apprentices daily instruction were considered to be eligible to participate as a supervisor in the study. Of the 18 supervisors, 11 supervisors agreed to be interviewed.

Data Analysis

Interviews were transcribed and uploaded into Atlas.ti qualitative data analysis software. The data was analyzed using an inductive, grounded approach (Glaser and Strauss 1999). This consisted of conducting a careful, detailed reading of each interview transcript, and assigning small, successive samples of text throughout the transcript to a code according to a concept or idea. These individual codes were then aggregated into larger, more conceptual overarching code groups by theme. These code groups then informed the higher level, theoretical categories, discussed in the results. The first phase of coding generated 219 codes, which were then aggregated into 12 code groups. In this paper, we focus on theoretical themes related to safety training, supervision, and communication.

The coding and analysis of the interview data was iterative and developed as the coauthors worked their way through the interviews. The coding and analysis were conducted by four of the coauthors. The coauthors coded the interviews separately and met to discuss their coding. They discussed the codes used by each of the authors and agreed on a universal code book, using the same code name to capture a concept relating to supervisory communication behavior and its impact on safety learning and practice. The coauthors also discussed whether or not a code was appropriate for a specific section of text, and when necessary, debated the most appropriate interpretation of the text, eventually coming to agreement on the code to assign.

Results

The Sample

Table 1 shows demographic characteristics of the participants. The majority of apprentice participants were aged under 25 years ($n = 23$; 76.7%), male ($n = 22$; 73.3%), and involved in the carpentry and joinery trade ($n = 20$; 66.7%). Three apprentices reported themselves to be Aboriginal or Torres Strait Islander (10.0%). This group was included in the sample specifically because Indigenous Australians are reported to be at greater risk of exposure to behavioral and environmental health risk factors than non-Indigenous Australians (AIHW and ABS 2005). Eight apprentices (26.7% each) were in the first, second, and fourth years of their apprenticeship program and six (20.0%) were in the third year. Supervisor participants were aged between 30 and 69. All of the supervisors were males. Eight supervisors indicated that they were site managers (72.3%) and three indicated that they were company owners (27.3%).

Differences in Supervisory Communication Practice

Apprenticeships provide an opportunity for young construction workers to apply the formal safety training acquired in the classroom

Table 1. Sample demographics

Occupational group	Item	Categories	Number	Percent (%)
Apprentices	Age range	15–19	8	26.7
		20–24	15	50
		25–29	4	13.3
		30–34	2	6.7
		40–44	1	3.3
	Gender	Male	22	73.3
		Female	8	26.7
	Aboriginal or Torres Strait Islander?	Yes	3	10.0
	Apprenticeship stage	No	27	90.0
		1st year	8	26.7
		2nd year	8	26.7
		3rd year	6	20.0
4th year		8	26.7	
Apprentice trade	Plumbing	8	26.7	
	Carpentry and joinery	20	66.7	
	Electrical	1	3.3	
Supervisors	Age range	30–34	1	9.1
		35–39	2	18.2
		40–44	2	18.2
		45–49	2	18.2
		50–54	2	18.2
		55–59	1	9.1
	Aboriginal or Torres Strait Islander?	65–69	1	9.1
		Yes	0	0.0
	Gender	No	11	100.0
		Male	11	100.0
	Job role	Female	0	0.0
		Site manager	8	72.3
Company owner		3	27.3	

to workplace practice. The results revealed a range of communication practices relating to safety and these practices played a role in establishing workplace norms and shaping apprentices' understanding of what is expected of them and their consequent safety-related behaviors. Connecting an idealized model of safety with practice is most successful when apprentices work with supervisors who have themselves internalized and model appropriate safety behavior. Our analysis found that interactions between supervisors and apprentices were key in establishing expectations about the importance of safety in relation to how work should be performed. For example, one apprentice described how repeated performance of a task according to his supervisor's expectation that it be done the "proper" way made safety a habitual element of work: "... there was no shortcuts with [the supervisor] really. Like, I think you learn better that way when there's no shortcuts, like you do everything proper, and it becomes a habit" (Thomas, 21-year-old second-year plumbing apprentice).

Some supervisors strongly, clearly, and consistently communicated to their apprentices that strict safety standards must be maintained under all circumstances. These supervisors talked openly about their expectations, demonstrated safe ways of working to apprentices, role-modeled good practice, monitored apprentices' performance, gave feedback, and corrected apprentices when necessary. These supervisors actively engaged apprentices in discussing how work would be undertaken and in planning and explaining the safety aspects of all tasks before commencement.

In contrast, other supervisors were reported to "turn a blind eye" to unsafe work practices, talking more about production efficiency and cost than about safety. These supervisors' interactions with apprentices rarely directly addressed safety. In one instance, one such supervisor instructed an apprentice to cut a metal object without

going to get their safety glasses, which were in her car, on the basis that “It’s only one cut. You’ll be alright.” However, this was the only instance in which a supervisor was reported to directly instruct an apprentice to work unsafely. In most cases, safety was not spoken about by these supervisors, leaving apprentices to make their own individual judgments of the relative priority of safety versus production efficiency and to make an individual choice as to what action to take in a given situation. Apprentices whose supervisors adopted this *laissez-faire* approach to safety indicated that, if they saw something unsafe on-site, they would not report it because they “just felt like no-one really seemed to care and everyone was just focused on getting the task done.”

A third supervisory approach reflected a more ambiguous approach to safety communication. In this approach, safety is neither emphasized nor ignored but is the subject of ongoing negotiation and adaptation to find the best ways of working in the physical context of the worksite. Table 2 presents characteristics of these distinct modes of supervisory communication observed in the data. The ideal case descriptions subsequently discussed elucidate how supervisor–apprentice interactions in each of these scenarios shaped the formation of apprentices’ norms and behaviors in relation to safety.

The frequency with which each communication characteristic occurred in the data is provided in Table 2 as an indicator of the importance of these characteristics in apprentices’ descriptions of supervisors’ communication activity. However, these frequency counts should be interpreted cautiously. Hannah and Lautsch (2011) argue that when the focus of a qualitative study is on understanding the perspectives of research subjects, assigning objective characteristics (i.e., numbers) to the issues of interest can focus attention away from the object of study, that is, the experiences of the research subjects, and the insights that insiders offer when sharing their personal experiences in relation to the research topic. While the results discussed in this paper are generated by the weight and emphasis of the emergent themes across the interviews, counting frequencies is arguably not well suited to the type of inductive and iterative data gathering and analysis approach deployed in this study (Hannah and Lautsch 2011). For these reasons, the frequency counts provided in Table 2 are included as corroborative information but should not be considered as the principal criteria against which results are assessed. Rather, the results focus more heavily on the detailed insights of the apprentices and supervisors who we interviewed and who described a range of safety related behaviors and environments of their worksites.

An Example of Safety-Focused Supervision

The experience of Kevin, a 33-year old fourth-year plumbing apprentice, provides an in-depth illustration of the ways in which interactions between supervisors and apprentices in the worksite context establish expectations about safety as an integral part of work practice. Kevin worked with a large commercial and residential company as part of a small maintenance and construction crew assigned to repairs and small construction work at a university campus. As a mature-age apprentice, he came to plumbing after a career in the mining industry, where he was exposed to repeated safety messaging. Despite his own orientation toward safety, and his confidence in raising safety concerns at work, Kevin emphasized the importance of his supervisors’ expectations and responses regarding safety as key in defining the ways in which safety was enacted on site. When asked what he normally did when he saw something unsafe, Kevin explained: “Well, for me, I’m mature age, so I suppose for me I feel it’s slightly different. I worked in the mines prior to this job, so safety—to me—is something that’s been drilled into me for a number of years now. So we do a lot of work on roofs at [site name], as well . . . we’ve got great bosses here, so we always come together and we talk about it, and come up with a different way to do something, or we just don’t do the job at all. And that’s—I think that’s really good, you know, that sort of attitude that we’ve got here coming from our bosses as well, is we don’t do anything—anything unsafe.”

As Kevin explained, his bosses fostered consultative interactions with their workers, coming together to discuss different ways to do a job, and deciding not doing the job at all, if it was unsafe. This type of interaction produced an approach that was unambiguously safety-oriented. This approach was reinforced by supervisors’ swift responses to workers’ requests for safety equipment: “Again, like I said, I’m very vocal if something doesn’t feel right, or it doesn’t feel quite—I will say. But if you ever need anything, whether it be specific shoes to get on a roof with, or you know, our harnesses are out of date, or you know, our PPE isn’t up to scratch, all I have to do is ask and it normally is right there and then. If not, you know, we can go and get it from the supplier . . . But I mean, when I’m on the site with [the company I work for], if I need anything, you know, nine times out of 10, if they haven’t got it, we just go and get it to make that job safe.”

Kevin further described his supervisors’ unequivocal support of safety: “. . . and like I said, if we need anything—like we brought up the other day we want the volleys [flexible soled shoes] to get on the roof, we don’t want to wear our big steel toe-caps; they were

Table 2. Themes arising from the inductive analysis

Supervisor–apprentice communication type relevant to safety learning and practice	Characteristics of supervisor–apprentice communication with impact on safety learning and practice
Safety-focused supervision	Supervisors are responsive to apprentices’ concerns/requests (68) Safety is a priority—won’t do a job if safety aspects are not satisfactory (59) Supervisors acknowledge apprentices’ knowledge learned in the classroom environment (55) Consultation and discussion about how to perform a task safely before commencing (27)
Laissez-faire supervision	Safety is traded off against production efficiency (cost and time) (34) Apprentices perceive unspoken expectations that safety compromises will be made (20) Apprentices take individual responsibility for their own safety (and in some cases the safety of others) (19) Supervision and instruction is limited (11)
Supervision emphasizing adaptation	Consultation and discussion about how to work takes place as the workplace material context evolves (60) Supervisors guide the use of adaptive practice (47) Safety incorporates the dynamic material context (43) Supervisors guide judgments about acceptable risk (40)

Note: Frequency with which each theme was mentioned is shown in parentheses.

ordered straight away without even a question, because we do a lot of work on the roofs. So whatever makes our job easier and safer, I suppose, they're on the ball, which is good."

Kevin also stressed that his supervisors supported shared decision-making with their team, and that they encourage and are receptive to new ideas raised by apprentices: "... and they're willing to listen to everyone: it's not like a boss who comes and tells you what the job is, and you do the whole job as a crew, and if someone sees something that thinks 'oh this could be a little bit easier,' regardless if you're an apprentice or not, you just—you speak up. And sometimes there is an easier way. That's what they like, because ... we're at TAFE and we're getting the brand new ways of doing things. They're not aware of that, so they like to have that input from apprentices, as well ... So they're just really—they're just really easy to talk to, they listen to everyone ..."

Kevin's insights reflect a workplace dynamic in which daily interactions with supervisors reinforce an unambiguous commitment to safety in both their words and their actions. This unequivocal prioritizing of safety is characterized by responsiveness to workers' safety concerns, immediate action, and the fostering of a consultative approach to problem solving that implicitly values the contributions of apprentices. As Kevin explained, his supervisors recognized that apprentices were exposed to the most up-to-date safety training through their formal education (TAFE), and sought this input when problem solving safety issues. The supervisors' deliberate incorporation of apprentices into a shared decision-making process and immediate and unquestioning action on safety issues combined to create an environment in which apprentices learned that compromising safety is not acceptable.

While Kevin acknowledged that his previous exposure to safety messaging made him more confident about raising safety concerns with his supervisors, other younger apprentices with less experience also described safety-oriented supervision. For example, 21-year-old Thomas worked with a large commercial company as a stage 2 plumbing apprentice. He recounted his experience with a supervisor who insisted on correct safety procedures. Thomas recognized and appreciated his supervisor's unwavering commitment to safety: "... he's a real perfectionist. But one good thing about him, he was really safety conscious, like he'd make you wear your safeties all the time, like your gloves, like long longs on, all the time. Like, he'd just drill it into ya ... Which was a bit annoying, but at the same time it's also good ... Because if something does happen, you know, at least, you know, you've got ya safety and like, it could save, I don't know, your eye, or who knows." Thomas added that although this was "annoying" to him in the early stages of his on-the-job training, over time, he grew to appreciate this safety-oriented supervision, acknowledging how it protected him, and recognized that the repeated messaging made this safety-oriented way of working habitual: "He was really into the PPE, which I thought was annoying at the start when I started, I thought 'Oh no.' You know, like this comes in handy."

Sean, a 21-year-old stage 3 carpentry apprentice, also worked for a large commercial company. In describing how well supported he felt by his supervisor and coworkers regarding safety, he explained, "But everyone is very—they don't beat around the bush; they'll tell you direct, and they make sure it's safe. So if they say—if they see that it's dusty or something we'll have to wear dust masks, so we have to always be clean shaven so we can wear dust masks. They're pretty clicked on." Sean recognized that his supervisors' expectations about unwavering adherence to safety guidelines, including how to use protective dust masks effectively, reflects how safety is prioritized in his workplace.

In these best-case scenarios, in which safety was valued and enacted by both apprentices and supervisors, all avenues of

interaction lead to safety. While Kevin's learning environment was ideal, it was not unusual, with other apprentices echoing his description of responsive and supportive supervisors who value safety. However, as the next scenario illustrates, this positive experience is not uniform across organizations, and different dynamics between supervisors and apprentices produce different understandings of safety at work.

An Example of Laissez-Faire Supervision

James, a 22-year-old apprentice in stage 4 of his 4-year apprenticeship worked with a building company in the residential construction sector. James described how his supervisor was often absent from the site when he was working: "I'm kind of my own supervisor. I do all—I—I look after a lot of his own job sites." James had been left to oversee the work of less experienced apprentices: "So I had about four job sites on the run, and I was looking after about four or five boys at the time." James was aware that the supervisors should be on-site at all times to give guidance and instruction to apprentices, but explained that his supervisor did not adhere to this requirement and, although he found it relatively easy to look after first-year apprentices, as an apprentice himself, James found the extra responsibility stressful.

When asked how he handled unsafe situations, James indicated that he would call the supervisor of the principal contractor at the worksite or his direct supervisor but, in some instances, he would make a judgment himself as to whether a situation was unsafe and what should be done: "I'd either call the supervisor in charge of that site, so it wouldn't be my boss it would be the head supervisor of the site, or I'd call my own boss, or I'd just deem it unsafe, like if we were on a scaffold and the scaffolding was missing."

James recalled a time when he found a scaffold that had missing components. In this instance: "... it wasn't tagged, it wasn't deemed safe to enter onto the scaffolding. But you know, when you do that you don't go up there, so you do other things." James made the decision to work at ground level or move to another site rather than use the scaffold for access to height: "[I] just stayed on the ground really. Did anything that was, you know, in the house or we just left and went to another job that was—had work."

When asked how he learned about safety James indicated that his only source of safety-related knowledge was the vocational education institution that he attended: "TAFE tells you how to do things safely, but no one else really. It's just, you know—you know, it's a no-brainer to be safe on site." He also expressed the view that staying safe on-site was a matter of individual choice and common sense: "[It's] just common—a bit of common sense ... like when you—when you get taught how to be safe, it's really then up to you how you put it out there on the job site. So you can either take—take it or you don't—if you don't listen and hear something, well it might happen to you—if you don't listen you'll get hurt."

James also explained that he has previously done things that he knew to be unsafe, and that this happens quite frequently: "at least once a week." For example, James described a situation in which roof trusses needed to be lifted into place but there was no crane on-site. James reflected: "it's either lose a day and have to come back, and you know, time is money, but in the end it's safety. But, you know, it's two trusses and then I've just moved them without, you know, having any fall stop or anything, but yeah, do that quite often, or you know, not just not having a handrail putting second storey frames up or, you know, just anything really, walking on heights." James explained: "... it's more time pressure. It's like you've got to get that done otherwise you're just going to have to come back for two hours tomorrow, but then it actually wastes half a day just going there to do one thing. So, you know, instead of

having to organise a crane to come that might take, you know, two days to get there—you just do it.”

When asked about the source of the time pressure James felt that led him to work unsafely, James indicated that, although his supervisor did not overtly instruct workers to work unsafely, there was a perception that the supervisor would react angrily if work was delayed in order to wait for a crane to arrive: “Um, well it’s not actually, you know, verbally said by someone higher than you. It’s more that you know that they’d be pissed off if it wasn’t done, you know.” The unspoken expectation that safety would be traded off against time pressure guided James’ decision-making: “They’re—they’re not going to say—they’re not going to put you at risk, but in a way, you know, they don’t want you to do it. They don’t tell you not to do it, you know what I mean?” When probed further, James described how his supervisor talked frequently about time and cost aspects of the job: “. . . just how they bring up, like you know, the job’s only worth a certain amount of money, and like when—when you’ve got a boss that talks about, you know, how much everything costs and like how much you’re only going to be getting paid, and you know, it’s meant to take a day, you know, it takes a day and then you’ve got to go back for another two hours in the morning, which wastes half a day. That’s, you know, half a day of wages for a few boys out of his pocket, so you know.” James explained that his supervisor’s comments in these “other contexts” communicated to him the expectation that time and cost take priority over safety.

Supervision Emphasizing Adaptation

A further theme in the interviews was the potential for ambiguity in relation to safety that exists in the context of the physical construction worksite. Construction sites are dynamic workplaces which, by their nature, are constantly changing. Safety is influenced by the physical worksite itself, including the spatial aspects of the site, materials being used, and the availability and use of tools and equipment. In this context, the interviews revealed that the application of safety knowledge learned in the classroom can sometimes be difficult and choices are made about which context-free safety-related protocols must be rigidly adhered to and when these protocols can be adapted to suit the specific conditions of a particular worksite.

It is through interactions with supervisors that apprentices learn to make judgments about where the boundaries between acceptable and unacceptable risk lie. Although the two scenarios previously described show best- and worst-case examples, the interviews revealed an extensive gray area in between these opposite supervisory styles. Within this gray area, supervisors engage apprentices in conversation in relation to how to bend safety rules in certain worksite circumstances. Thus, the gap between classroom-learned safety knowledge and how work is performed on-site is the subject of discussion and the practice of making risk judgments and adaptation is learned by apprentices.

For example, Gavin, a 20-year-old in the third year of his carpentry and joinery apprenticeship, described a situation in which his supervisor chose to follow an erection process for a shed that involved working from a ladder to fix components in place rather than erecting a scaffold. Gavin explained: “So we had a job last year which was on top of a concrete wall—about two metres high, so about a two metre drop off, and the shed was going up, I think it was three metres wide by 2.6, if I’m not wrong, which made it about 2.8 metres high, so you’d need a scaffold or a bigger extension ladder . . . Uh, we ended up—we pre-fabbed it, and just used a ladder, because right next to it we could just look over the roof anyway. So there was in between, like, the drop off platform, and

then it goes up again onto grass so we just used a ladder. Uh, yeah, it was the right choice, otherwise it would have been too hard to get the frames in.” The supervisor’s decision-making about how to perform this task in the context of worksite physical constraints and technical requirements reflects the type of adaptive practice that apprentices learn through their on-the-job training. This practice can deviate from the context-free safety knowledge taught in a classroom.

A similar experience was shared by Zach, a 21-year-old carpentry and joinery apprentice who described a situation in which bracing was used to stabilize a ladder from which he and his supervisor were working: “So, last week we popped around at a client’s house. They had a leaking window, and in the end, it wasn’t actually the window, it was, the gutter was overflowing with leaves and filling up with water, and then that tracking underneath the eave boards . . . So, we had to get up quite high on the ladder. At first, like I thought, it was pretty hard to get access in there, but we were able to get the ladder to, like, almost full extension but also have the ladder braced up . . . We were just kind of bouncing ideas of—how we can make the ladder more stable—and make it safer for us to climb up and down it, because we’d have to be doing a few trips up and down.”

Both of these examples illustrate that the ability to make risk judgments (i.e., understanding which factors should be considered in a particular situation and how these factors should be weighed up against each other) is an essential part of becoming a skilled tradesperson that apprentices learn through interactions with their supervisors in the physical worksite environment.

The supervisors similarly described how they deliberately used changing local site conditions to facilitate this learning in their apprentices. For example, Patrick, a 50-year-old site manager at a large commercial construction company, shared how he engages apprentices in reviewing and adapting safety rules and procedures to respond to unexpected problems that arise: “Everything would have a site-specific task. Some would have risk assessments, and then what we’d do is we’d have the SWMSs [Safe Work Method Statements], JSAs [Job Safety Analyses] whatever you want to call it. But I actually see that as a rolling document, so then we’ll pick the SWMS up and go, ‘Oi, this doesn’t actually work. How are we going to do this?’ So, the majority of SWMSs that we have, there’d be scribbled on the back and they’d be hand-written, ‘We’ve actually gotta do this. This is how we’re gonna do it.’ . . . and then we’ll talk about how we’re gonna do it. ‘Hey, do you need another guy to help you with this?’ ‘Hey, do you need three guys?’ ‘Yeah, that wouldn’t go amiss.’ ‘Right, are we happy with doing that? That’s what we’ll do.’ If something crops up during this process, stop what we’re doing and we’ll have another chat about it. And if it doesn’t work, we’ll come up with something that does.”

Patrick also stressed the role of supervisors’ communication skills in facilitating apprentices’ engagement in problem-solving, which is an essential component of site-based learning: “So, it’s basically communication, discussion, making people feel that they can say something, not that whatever they say might be silly. Even—anyone can chip in, anyone can contribute. Uh, different pair of eyes, whether it’s a young pair of eyes or an old pair of eyes, what does it matter? So, just making them feel comfortable that they can contribute to that conversation, ‘cause they’ll be doing it.” These insights from Patrick, and the experiences recounted by Gavin and Zach, illustrate that enacting safety is itself a dynamic process which depends on evolving material conditions, and that supervisors play a key role in apprentices’ acquisition of knowledge about how to adapt to changing safety circumstances.

Discussion

The Supervisor's Role in Apprentices' On-the-Job Safety Learning

Our findings support arguments that young workers learning about safety in the workplace through social interactions (Nielsen et al. 2012). Supervisor-apprentice interaction is a critical determinant of effective on-the-job learning, including about safety (Lopata et al. 2015; Westaby and Lowe 2005). Consistent with Gherardi and Nicolini (2002), our interviews suggest that safety is learned through “an active reciprocal endeavour” (p. 2016) that involves seeing how others behave in the worksite environment, participating in conversations about how work is to be done and attempting to perform work in ways that are considered appropriate in the social and cultural context of the worksite (Rooke and Clark 2005). Thus, active and engaged supervisors who role-model good practice and talk frequently to apprentices about the safety aspects of the work they are doing are likely to support good learning outcomes in relation to safety.

Our results revealed that some supervisors do this very effectively. These supervisors are very safety-focused and establish clear and unambiguous expectations in relation to how work should be done. Safety-focused supervisors talk with their apprentices about the safety aspects of performing a task, are responsive to apprentices' questions and requests and draw a clear line between acceptable and unacceptable work practices. The apprentices who work with safety-focused supervisors understand safety to be an important and integral part of task performance.

However, not all supervisors establish such clear and positive behavioral norms in relation to safety. Some supervisors adopted a style of interaction with apprentices that we have referred to as *laissez-faire*. These supervisors did not engage apprentices in conversations about safety and gave them little safety-related instruction. This left apprentices to make personal (rather than collectively discussed and decided) choices about appropriate ways of working. In some instances, dangerous work practices were adopted as safety was traded off by apprentices against time and cost considerations. Although *laissez-faire* supervisors generally did not overtly instruct apprentices to work in unsafe ways, their lack of involvement and oversight of apprentices' work created an ambiguous learning environment for apprentices in relation to safety.

More or Less Safety?

Our results also reveal that apprentices' on-the-job training involves learning how to traverse the gap that can exist between idealized safety models and practical site-based realities (Grytnes 2018, p. 354). Sherratt (2016) argues that safety has been polarized into two terms—safe and unsafe—leaving little room for anything in-between. Yet on a construction site, the reality is more complex. Construction sites are constantly changing work environments and workers deal with danger in informal and emergent ways (Baarts 2009). Many practical ways of working in this context may be best described as “slightly unsafe” (Sherratt 2016). Ozmec et al. (2015) similarly reported that, in the context of competing project goals, construction workers' safety may be better understood as a “more-or-less” rather than an “either-or” proposition. This is not to suggest that unsafe ways of working are acceptable, but to acknowledge that the construction site environment is far less predictable and stable than idealized models of safety would suggest. Indeed, work is shaped by a complex interplay between social and material factors that can create a substantial gray area when it comes to safety. Within this context, apprentices observe and learn what factors are

considered when decisions are made, how these factors are weighted and what is prioritized and when.

Our findings highlight the role of supervisors in determining the boundary of acceptability on a safety “continuum,” yet supervisory practice varies in where this unspoken and invisible line should be drawn. Some supervisors are “sticklers” for safety rules. These supervisors are described by apprentices as “good” supervisors whose actions have a positive impact on on-the-job learning. Other supervisors either overtly or covertly prioritize production efficiency over safety with the result that apprentices feel that they have no option but to work in ways that they know to be dangerous.

Interaction between Social and Material Environmental Factors

The contingent and emergent nature of safety in the constantly changing work environment was evident in participants' discussion of formal safety documents, including Safe Work Method Statements (SWMSs) that were described as “rolling documents.” Rather than being inflexible prescriptions of how work should be carried out, in reality these documents are changed in the field in response to site conditions. The review and amendment of SWMSs are often undertaken in a participatory way, involving group conversations (facilitated by the supervisor) about how best to perform a task. Participating in this process, apprentices observe how risk judgments are made, including factors considered when deciding how to work. Thus, on-the-job learning involves learning not only about how to perform the physical tasks inherent in a craft, but also how to identify and respond to risks encountered in the physical worksite environment.

Supervisors indicated that they actively use a participative style of supervision to facilitate their apprentices' learning with regard to dealing with changing site physical conditions. When supervisors seek apprentice input and suggestions as to how to perform work tasks in uncertain worksite environments, this provides an opportunity for apprentices to learn how to balance situational, technical, and safety requirements in their problem solving. Supervisors with a participative style involve subordinates in conversations about how to perform a work task before making a decision (Sauer 2011). Participative supervision is reported to positively affect learners' learning experience and improve learners' job performance (Newman et al. 2016; Grill et al. 2017). However, as previously noted, supervisor–apprentice interactions can explicitly or implicitly trade-off safety against cost-effectiveness and workload. Depending on the individual supervisor's judgments, these interactions may therefore induct apprentices into normalized practices that may be more or less safe (see also Grytnes et al. 2021).

Implications for Practice

Safety training for young workers often focuses on changing safety-related attitudes and behavior without taking into consideration the way that the sociomaterial context of the workplace influences young workers' work and safety practices. The results of the present study highlight the important role played by supervisors in shaping young workers' safety experiences and shaping how young workers learn to adapt to site-based challenges that they will inevitably experience in the dynamic and unpredictable worksite environment.

Our research indicates that developing the skill of dealing with emerging issues with flexibility and adaptability is critical for apprentices working in a constantly changing and unpredictable site environment. Supervisors can help apprentices to develop these

skills by adopting a participatory and consultative style of leadership and encouraging apprentices to contribute to problem-solving discussions. Participation in these conversations builds apprentices' understanding of how risk judgments and decisions relating to ensuring an acceptable level of safety while managing the situational and technical requirements of work are made.

The findings highlight the limitations inherent in relying on "information-giving" interventions to keep apprentices safe. While it is important to provide apprentices with knowledge about workplace safety, traditional classroom training does not consider the social environment in which apprentices work. The workplace social environment (in particular the apprentices' interactions with their supervisors) plays a critical role in the situated learning of safety. Interventions designed to ensure that supervisor–apprentice communication supports learning to adopt good safety practices should therefore be considered. Similarly, interventions that evaluate and improve safety capability and practice within training organisations can help to ensure workplaces are well-prepared to support apprentices on-the-job safety and safety learning (Nielsen et al. 2019).

Conclusions

Previous research has demonstrated the importance of supervisors' communication behaviors in shaping workgroup safety climate and worker behavior in relation to safety. The present study extends this work by examining in detail the way that supervisors' interactions with construction apprentices impact the way that safety is learned and practiced in the workplace, providing important insight into one of the mechanisms through which supervisors can shape safety outcomes for young and inexperienced workers. In particular, the findings highlight the important role played by supervisors in setting unambiguous and high safety standards and demonstrating good practice in relation to how to respond to risk amid changing and sometimes challenging physical worksite conditions. The research highlighted that interactions with supervisors contribute substantially to apprentices' learning about what constitutes a normal or acceptable level of risk. Importantly, supervisors vary considerably in the expectations they demonstrably set in relation to safety. Some supervisors establish safety as a very strong and clear priority, while others emphasize production efficiency creating ambiguity in relation to the importance of safety. Our research also indicates that developing the skill of dealing with emerging issues with flexibility and adaptability is critical for apprentices working in a constantly changing and unpredictable site environment. Supervisors can help apprentices to develop these skills by adopting a participatory and consultative style of leadership and encouraging apprentices to contribute to problem-solving discussions.

In highlighting the important role of supervisors in shaping apprentices' on-the-job safety learning and experiences, the present research demonstrates the inherent limitations of "information giving" safety training programs for construction apprentices. Such programs do not adequately reflect the fact that safety learned in the classroom may not translate easily to the worksite unless the social context of work is sufficiently supportive. Given the key role played by supervisors in facilitating apprentices' on-the-job safety learning, there are opportunities to improve training outcomes by developing better safety leadership and communication skills among supervisors who take apprentices into their workplaces.

The research has several limitations. First, the study was undertaken in New South Wales. However, due to the adoption of a similar apprenticeship models throughout Australia, it is likely that the findings will have some level of generalizability beyond New South

Wales. However, similar research could potentially be undertaken in other States/Territories of Australia. Second, this study only focused on the influence of interactions between supervisors and apprentices on apprentices' safety learning. Future research should investigate how apprentices' safety learning is impacted by their interactions with coworkers in the workplace. Third, this study considered the sample of apprentices as a homogeneous group without making any between-group comparisons. Future research should compare the on-the-job learning experiences between apprentices working in different industry sectors (e.g., residential and commercial sectors) and/or working for different types of organizations (e.g., large construction companies versus small construction companies). This would identify whether apprentices' learning experiences are affected by characteristics of a specific sector or type of organization.

Notwithstanding these limitations, the research provides a rich new insights into the way that supervisor–apprentice interactions influence the way that apprentices learn about safety in the workplace and also what is learned.

Data Availability Statement

Some or all data, models, or code generated or used during the study are proprietary or confidential in nature and may only be provided with restrictions.

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