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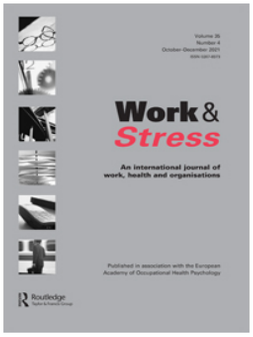

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A mixed methods study of the training transfer and outcomes of safety training for low-skilled workers in construction

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ABSTRACT

Safety training, especially when based on the active participation of trainees and aiming for transfer of learning into the workplace, is an important tool to prevent accidents and promote occupational safety, and may be particularly powerful among vulnerable groups, such as migrant workers. The present study, employing a mixed methods, before-and-after study design, evaluated a training programme aimed at promoting the learning and transfer of technical and non-technical safety skills to the construction site among migrant and native workers. We explored outcomes at four levels and found: (a) trainees' positive reactions to the training itself; (b) improvements in technical safety skills, but the non-technical skills reduced significantly; (c) application of these skills in the workplace; and (d) changes in site safety climate and assertiveness. Results showed that trained workers found the training easy to translate into the workplace and that peers and supervisors were supportive of training transfer. Our study has important implications for how to evaluate safety training of migrant workers and how the context may facilitate training outcomes, e.g. ensuring that peers and supervisors encourage trained workers to transfer their learned skills and knowledge.

KEYWORDS

Safety; training; low-skilled workers; training transfer; mixed methods; evaluation; migrant workers

Every 15 s, 150 workers have a work-related accident and one worker dies (International Labour Organisation [ILO], 2018). The construction industry is considered a high risk sector (e.g. Buckley et al., 2016). In 2017, over 1 in 5 fatalities at work in the European Union Member States (EU-28) occurred in the construction sector (Eurostat, 2019). In response to these disconcerting rates, the European Commission developed a strategic framework on safety and health at work (European Commission, 2014) focused on promoting occupational safety and health management, e.g. through training. A particular challenge in the construction sector is the reliance on migrant workers (Eurostat,

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2011); people engaged in remunerated activity in a state of which they are not national (United Nations [UN], 1990). Migrant workers are particularly vulnerable as they are often low-skilled, face language barriers, come from countries with different safety cultures, and are exposed to relatively more hazardous work (e.g. Dong et al., 2010). As a result, accident rates are higher among migrant workers compared with native workers (e.g. Dong et al., 2010).

Despite safety training being acknowledged as an effective way of improving safety at work (Freitas & Silva, 2017), a recent systematic literature review (Peiró et al., 2020) revealed that safety training of migrant workers in construction is rarely rigorously evaluated. The aim of the present study is to evaluate the effectiveness of a safety training programme among migrant workers in construction (the CSTP; Vignoli et al., 2021) and how training transfer and peer and supervisor support may facilitate a successful outcome. We used the recently developed Integrated Safety Training Evaluation Model (IMSTEM, Nielsen et al., 2021) as our evaluation framework.

The main contributions of our study are threefold. First, current safety training of migrant workers suffers from three limitations: (a) safety training has focused primarily on technical skills, e.g. the use of Personal Protection Equipment (PPE) (Peiró et al., 2020), however, learning non-technical skills (NTS) is equally, if not more, important to ensure training is transferred to the workplace (Shepherd et al., 2021). NTS can be defined as "cognitive, social and personal resource skills that complement technical skills, and contribute to safe and efficient task performance" (Flin et al., 2008, p. 1); (b) training of migrant workers has primarily translated training materials into migrant workers' native language (Peiró et al., 2020); and (c) no evaluations of migrant worker safety training has been conducted in Europe where the migrant worker population is diverse and rarely speak the same has been conducted in European settings language (Peiró et al., 2020). Migrant workers often have different values and attitudes about safety than those of the host country (Brunette, 2005) and this calls for training migrant workers and native workers together to promote social construction of a shared understanding of safety issues (Peiró et al., 2020). We evaluate the CSTP aimed at migrant and native construction workers using innovative methods to facilitate technical and NTS skills learning in two European countries.

Second, Kirkpatrick's training evaluation model (1994) is the dominant model (Saks & Burke, 2002) to understand training outcomes and explores the effects of training at four levels: reactions, learning, behaviours, and results. While previous of studies of migrant workers safety training have focused on learning and behavioural changes, few studies evaluated all four levels of outcomes and none of the studies found an effect in terms of results (Peiró et al., 2020). Furthermore, the Kirkpatrick model has been criticised for failing to consider how external factors, such as support, influence outcomes, and research has failed to confirm that changes in one level leads to changes at the next level (Alliger & Janak, 1989). The training transfer literature suggests trainees need to apply and maintain skills and knowledge once they return to the workplace (Baldwin & Ford, 1988). Based on the IMSTEM (Nielsen et al., 2021), we integrate training transfer and outcome evaluation of safety training of migrant workers in construction.

Third, we address the call of Peiró et al. (2020) to evaluate training using a mixed methods approach. Building on Nastasi et al. (2007) we use qualitative methods to

supplement before and after quantitative evaluation. The use of qualitative methods enable us to explore the underlying mechanisms of change, i.e. training transfer. We contribute to the existing literature on the evaluation of safety training of migrant workers by employing both qualitative and quantitative methods to understand the outcomes of training and the factors that may have influenced these outcomes.

Development of research questions

The IMSTEM suggests that Kirkpatrick's levels of outcomes and training transfer should be integrated (Nielsen et al., 2021). We developed six research questions (RQ), one for each of the level of outcome in the Kirkpatrick model (1994), and two reflecting key aspects of training transfer, i.e. whether trainees experienced skills and knowledge acquired during training could be translated into behaviours in the workplace and the amount of support by colleagues and supervisors to transfer skills and knowledge into the workplace (Burke & Hutchins, 2007).

Outcome 1: Reactions to training.

In line with Kirkpatrick's training evaluation model (1994), we suggest that the first outcome that should be evaluated is trainees' reactions to training. If trainees do not view the training in a positive light, learning is unlikely to happen. The training transfer literature has identified key elements of training that must be appraised positively: structure of training content, trainers' ability to engage and convey training material and training methods (Burke & Hutchins, 2007). Due to language barriers, migrant workers in particular rely on visual material (Peiró et al., 2020), making trainees' reactions to training materials particularly important. We, therefore, formulated our first research question:

RQ1: Did trained workers appraise the training positively in terms of (a) the training structure, (b) the trainers' ability to engage workers and convey training material and (c) training methods supporting learning?

Outcome 2: Learning.

The second level of Kirkpatrick's (1994) model is learning. The CSTP has two key learning objectives: Learning technical skills (mechanical, electrical, equipment, physical, chemicals, goods handling, interference, and subcontracting skills) and NTS, i.e. moving from concrete thinking, e.g. how to use PPE, to abstract thinking, e.g. analysing the situation to determine when and what PPE to use (Vignoli et al., 2021).

The NTS taught are situational awareness, communication, teamwork, decision-making, and stress and fatigue management (Flin et al., 2008). *Situational awareness* refers to workers constantly monitoring the environment by observing and detecting potential changes and threats or hazards. *Decision-making* relates to observing and evaluating risks or hazards, and, based on these evaluations, taking informed action. *Communication* refers to workers communicating about observed risks and hazards. *Teamwork* involves the understanding that safety at work is a shared responsibility and that workers care about each other's safety at work. Finally, *Stress and fatigue*

management refers to coping with fatigue and managing stress. The literature review by Peiró and colleagues (2020) did not identify any studies focusing on these NTS. To reflect these two learning outcomes, we formulated the following research question:

RQ2: Did trained workers report learning (a) technical skills, i.e. the acquisition of skills concerning mechanical, electrical, equipment, physical, chemicals, goods handling risks, and use of PPE; and (b) NTS, i.e. situational awareness, decision-making, teamwork, communication and stress, and fatigue management?

Training transfer: Translation acquired skills and knowledge to the workplace

One criticism of the Kirkpatrick model (1994) is that changes at one level do not necessarily lead to changes at the next level (Alliger & Janak, 1989). One explanation for the lack of support linking learning to changes in behaviours could be because trainees need to translate learning into changes in behaviour and this translation may not happen easily (Burke & Hutchins, 2007). For example, it is important that PPE training relates to the situations workers face in the construction site where they may need to make decisions about which PPE to use. Likewise, opportunities to use skills and knowledge predict changes in behaviours (Salas et al., 2012). If trained workers do not get the chance to employ new skills and knowledge, (e.g. for NTS, communicate with colleagues) then changes in safety behaviours are unlikely to occur. Therefore, we suggest that, in order to observe any changes in behaviours, trained workers must experience that they can use the skills and knowledge across a range of settings without having to make too many adaptations to translate skills and knowledge into behaviours. We, therefore, formulated our third research question:

RQ3: To which extent did trained workers perceive skills and knowledge to be applicable in the construction site?

Outcome 3: Behaviours

At the third level of the Kirkpatrick model are behaviours (Kirkpatrick, 1994). As for learning, we would expect changes in two sets of behaviours: Technical skills and NTS application. Technical skills can be captured through safety compliance, i.e. the extent to which workers use the necessary safety equipment and follow safety procedures (Neal & Griffin, 2006). NTS can be captured through trained workers' reports of whether they engage in behaviours relating to the five NTS, communication, teamwork, situational awareness, decision making and stress and fatigue management (Mariani et al., 2019). We thus formulated our fourth research question:

RQ4: Did workers report engaging in behaviours relating to (a) technical skills and (b) NTS at the construction site?

Outcome 4: Results

The fourth level of the Kirkpatrick (1994) model refers to results or end goals beyond immediate changes in trainees' behaviours, e.g. safety proactivity whereby workers take responsibility for safety in the workplace and creating a good safety climate (Neal & Griffin, 2006). In order to understand whether broader results can be found, it is

important to evaluate whether safety proactivity increased. None of the studies included in the Peiró et al. (2020) literature review considered safety proactivity,; four studies explored assertiveness, but found inconsistent results. Assertiveness may be an important proactive safety behaviour as migrant workers often work under suboptimal conditions and pressure from supervisors to ignore safety standards (Brunette, 2005). We thus formulated our fifth research question:

RQ5: Did trained workers report higher levels of safety proactivity post-training and were there wider results of training in the construction site beyond the expected outcomes such as assertiveness?

Context: peer and supervisor support for training transfer

Contextual factors may influence trained workers' ability to transfer skills and knowledge to the construction site. A meta-analysis of the training transfer literature found that peer and supervisor support are strong predictors of training transfer (Blume et al., 2010). The two types of support may be particularly important in safety training of migrant workers in the construction industry, who have reported poor relationships with supervisors, characterised by language barriers (Donaghy, 2009), abuse (Dutta, 2017), and pressure to neglect safety to keep up performance (Choudhry & Fang, 2008). Migrant workers often work in close-knit units under pressure to perform as work is piecemeal and thus peers may also apply pressure to prioritise performance over safety (Brunette, 2005). Furthermore, among certain groups of migrant workers, a macho culture persists (Peiró et al., 2020), which may prevent trained workers to translate skills and knowledge from training to the construction site. We therefore formulated our sixth and final research question:

RQ6: How did supervisors and peers facilitate or hinder training transfer?

Methods

Study design and participants

We employed a mixed methods before-and-after study. We use a before-and-after knowledge test to evaluate whether knowledge and skills about correct safety behaviours have increased. Using a before-and-after questionnaire, we explored whether there were behavioural changes in technical skills and NTS. We triangulated these quantitative data using interviews with trained workers, exploring their experiences with learning and changes in behaviours of technical skills and NTS. The training was completed before the COVID-19 pandemic, but the follow-up took place during the pandemic, in the summer of 2020, which meant that many workers were either furloughed, laid off, or had found employment in other sectors, as construction had almost come to a complete halt.

We further used worker interviews to explore wider changes in safety climate in the workplace and trained workers' experiences of how easy it was to transfer knowledge to the construction site, exploring context and mechanisms. We analysed worker interviews to explore the support for transfer from colleagues and supervisors supplemented with supervisor interviews of the strategies they employed to support workers' training

Table 1. Overview of research methods applied to evaluate training.

	Quantitative methods		Qualitative	
Focus	Knowledge test (Before and after training)	Survey (Before and 6 months)	Trainee interviews (6 months post training)	Supervisor interviews (3 months post training)
Level 1: Trainee reactions to training			X	
Level 2: Learning	X		X	
Mechanism: Translation and adaptation			X	
Level 3: Behaviours		X	X	
Level 4: Results			X	
Context: Peer support for transfer			X	
Context: Supervisor support for transfer			X	X

transfer to understand the context of transfer. Table 1 provides an overview of the methods used in the study including how each method contributes to evaluating each level of outcomes, training transfer and peer and supervisor support for transfer.

Due to the Covid-19 pandemic, we included specific questions about safety and working during the pandemic in our follow-up survey. Semi-structured interviews were conducted with supervisors of workers, who had participated in training three months after training had been completed, and with a sample of trained workers six months post-training. The study took place in the construction industry in Italy and Spain. The lead university in the project obtained ethics approval from the department's ethics committee and this approval was approved by the ethics boards in the universities of project partners.

The surveys were distributed to all workers participating in training. Six months after the last training session, trained workers completed the follow-up. For the baseline survey (T1), the survey was distributed to 119 workers. As paper surveys were distributed in-person on the morning of the first day of training, there was a 100% T1 response rate; however, only 107 completed the training. Six months after completing training (T2), 57 of these workers completed the questionnaire (response rate = 47.9%). Participants were construction workers in Spain and Italy. The majority of the sample was male (96.2%). The average age was 34.6 years ($SD = 14.58$) and mean organisational tenure was 3.9 years ($SD = 6.70$). Participants reported a wide variety of jobs within construction, with the three most common types being "Labourer" (40.2%), "Concreter" (7.8%) and "Welder" (3.9%). 56% were trained in Spain and 44% in Italy. Native workers comprised 50.5% of the sample, 29.5% were non-EU, non-native speakers, 11.4% were EU, non-native speakers of the host country, and 8.6% were non-EU, native speakers. In Spain, migrant workers came from 13 countries, with the largest representation from Colombia (8.70%), with other countries also represented, such as Ukraine (4.35%), Ecuador (4.35%) and Bolivia (4.35%). In Italy, migrant workers also came from 13 different countries, with the largest representations from Romania (16.39%), Moldovia (6.56%), and Pakistan (6.56%).

Analyses testing for systematic dropout from Time 1 to Time 2 revealed no significant differences between those who only responded at Time 1 to those who responded both times in terms of age, gender, migrant worker status, country of training, the five NTS, safety proactivity, and safety performance, save for one of the non-technical skills: Participants who responded to just T1 scored significantly lower on decision-making skills ($M = 4.40$, $SD = .61$) than those who completed both surveys ($M = 4.55$, $SD = .66$), $t(83) = -2.302$ ($p < .05$).

The training

The training evaluated is the CSTP (Vignoli et al., 2021), developed as a part of the Erasmus+ funded ESTEEM project (European Safety Training and Evaluation supporting European Mobility) project, which aims to address the challenges of safety training for migrant workers in three European countries (UK, Spain, and Italy). To ensure consistency of training across the two countries, a training manual for training was developed and the research team delivered a train-the-trainer session for trainers in the two countries. The only difference between training delivery in the two countries was that country-specific statistics (concerning accidents and injuries) and legislation were tailored to the national context. Trainees completed the CSTP during working hours and were paid overtime to complete the online elements of training.

The CSTP considers sensemaking, feedback, and social interactions between trainers and trainees and among trainees themselves as fundamental aspects of learning. The CSTP consists of 24 h in total: 20 h in class and four hours of online training on a dedicated, interactive platform tailored to construction workers. The in-class training was composed of five training units (learning walls) of four hours each. The second training unit comprised of mandatory training in Spain and Italy concerning technical skills. There were a few of days between each training unit, which allowed for the inclusion of action planning activities, in which trainees transfer what they have learned in the course into their working environment and then discussed potential transfer barriers with the trainers and other trainees during the subsequent training unit.

The content of the training comprises both technical skills (as required by the national regulations on safety training) and NTS. Specifically, the CSTP integrated NTS and technical skills using a teaching methodology that relies on group activities and trainee interaction. The CSTP is dedicated to construction workers and it is recommended that participants are from different nationalities to ensure key learning is transferred to the workplace. An online platform supplemented in-class materials (e.g. links to safety websites, interactive games) by testing trainees' knowledge and encouraged further learning in the trainees' own time. The games provided immediate feedback to the trainees. At the end of the training, trainees who successfully passed the knowledge test were awarded a training certificate, specifying the contents of training.

Data sources

Our mixed-methods design allows us to triangulate learning, behaviours and results, and to understand the reactions, mechanisms (adaptation and translation) together with the contextual factors (peer and supervisor support) influencing outcomes (Nastasi et al.,

2007). We developed a study protocol for the evaluation to ensure consistent evaluation across the two countries. See Table 1 for an overview of data sources.

Knowledge test

A knowledge test was developed to test trainees' learning. Participants completed the test before and at the end of the training. This test consists of 16 questions:14 multiple-choice questions to assess knowledge of technical skills and 2 open-ended questions to assess knowledge of NTS. Due to technical problems, 22 Italian participants completed a shorter version of the test composed of 10 multiple choice questions, rather than 14. For this reason, test scores were standardised by dividing the number of correct answers over the total number of questions, creating a value that can be easily understood as a percentage. For example, a transformed score of .75 would mean the participant scored 75%.

Survey

The following eight measures were included in the survey: *Safety compliance* was captured using a three-item by Neal and Griffin (2006). An example of an item is: "I use the correct safety procedures for carrying out my job" (T1 $\alpha = .74$, T2 = .62).

The five behaviours relating to NTS were taken from the Mariani et al. (2019) scale, which consists of 20 items and five different dimensions, each with four items. The NTS measured were: *Situational awareness*. An example of an item is: "I foresee possible future hazards while I'm working"; (T1 $\alpha = .81$, T2 $\alpha = .84$); *Teamwork*. An example of an item is: "I care about my colleagues' safety" (T1 $\alpha = .76$, T2 $\alpha = .81$); *Decision-making* (example item "When required, I make quick decisions to ensure safe working") (T1 $\alpha = .81$, T2 $\alpha = .70$); *Communication* (example item "I communicate effectively about safety with colleagues") (T1 $\alpha = .81$, T2 $\alpha = .81$); *Stress and fatigue management* (example item "I recognise the causes of mental fatigue that pose a risk to working safely") (T1 $\alpha = .80$, T2 $\alpha = .88$).

Safety proactivity was measured by the three-item measure by Parker et al. (2006). An example of an item is: "I implement ideas for safety improvements myself" (T1 $\alpha = .76$, T2 = .78).

All the above measures used a Likert-type response scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). In light of the COVID-19 pandemic, we also included an item "Do/did you work during the coronavirus lockdown?" with the response categories of "Yes, I worked more than what I would have normally worked," "Yes, I worked the same amount as I would have normally worked," "Yes, I worked less than what I would have normally worked" And "No, I did not work during the lockdown."

Interviews

Twenty-five workers who had completed training were interviewed six months post-training, at the same time as the follow-up survey was distributed. Workers were randomly selected, but participation was voluntary and another worker was randomly selected if one declined. Ten workers in Italy declined to participate, while all workers in Spain agreed. We used semi-structured interviews (Brinkmann & Kvale, 2015) to explore trained workers' memory of training six months later by asking them to report what they remembered learning during the course and how they had applied

this learning in the construction site; colleagues and supervisors' reactions to workers' attempts to transfer training, and the barriers and facilitators to training transfer. All data were recorded and transcribed ad verbatim. Ten workers from Italy were interviewed (five native workers and five migrant workers) and 15 from Spain were interviewed (seven native workers and eight migrant workers), all were male. Worker interviews lasted between 2:12 min and 17:13 ($M = 8:39$). Participants were anonymised and allocated a random number and a letter indicating whether they were migrant (M) or native (N) workers.

Eighteen supervisors of workers who had participated in training were interviewed three months after workers had completed training. We again used semi-structured interviews (Brinkmann & Kvale, 2015) and asked about the strategies that supervisors employed to support trained workers in transferring skills and knowledge to the workplace. In Italy, a random selection of trainees' supervisors was interviewed ($N = 10$) while in Spain, all supervisors were interviewed, bar one who was uncontactable ($N = 8$). All supervisors were male. Supervisor interviews lasted between 2:02 min and 27:06 min ($M = 8:12$). Supervisors were anonymised and allocated a random number.

Data analysis

RQs 1, 3 and 6 were answered using interviews only. RQ 2 was answered using interviews and the knowledge test and RQs 4 and 5 were answered using interviews and survey data.

Qualitative data analysis

We used thematic analysis (Braun & Clarke, 2006) to analyse both supervisor and worker interviews. In the first phase, we familiarised ourselves with the data, creating initial codes. In the second phase, we coded data according to reactions, learning, adaption/translation, behaviours, results, and support. We created sub-codes for technical skills and NTS and supervisor and peer support. In the third phase, we identified and refined themes. In the fourth phase, we wrote up results for this paper.

Quantitative data analysis

All quantitative analyses were conducted using IBM SPSS version 26. To answer RQ 2, we conducted a paired sample t-test to explore before and after training differences in the knowledge test. To answer RQs 2, 4, and 5 we conducted linear mixed models analyses to explore changes relating to technical skills and NTS between Time 1 (T1) and Time 2 (T2). Following preliminary correlation analysis, we controlled for age and country of training when examining safety proactivity and four of the NTS (situational awareness, decision-making, communication, fatigue management), and we controlled for migrant status, age, and country of training when examining teamwork.

Results

Table 2 shows the means, standard deviations, and correlations. In the following, we present the mixed method results in response to our research questions.

Table 2. Means, standard deviations, reliabilities and correlations of trained workers.

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age	35.46	14.58																	
2. Gender	1.98	.19	.09																
3. Migrant	1.50	.50	.20	−.10															
4. Country	1.42	.50	.29**	.18	.09														
5. T1 Teamwork	4.45	.60	.17	−.15	.09	.24*													
6. T1 Situational awareness	4.51	.59	.20	−.04	.04	.09	.66**												
7. T1 Decision-making	4.40	.65	.28*	.03	.10	−.04	.59**	.78**											
8. T1 Communication	4.35	.67	.27*	.08	−.07	.05	.64**	.69**	.63**										
9. T1 Fatigue management	4.20	.83	.16	.03	−.02	−.03	.33**	.46**	.73**	.46**									
10. T1 Safety compliance	4.46	.66	−.03	−.003	−.06	.001	.41**	.55**	.54**	.49**	.53**								
11. T1 Safety proactivity	4.24	.90	.26*	−.01	.04	−.10	.51**	.48**	.53**	.62**	.38**	.51**							
12. T2 Teamwork	4.23	.61	.41**	−.01	.34**	.51**	.15	.24	.06	.11	−.04	.12	.22						
13. T2 Situational awareness	4.09	.65	.39**	.03	.20	.46**	.14	.09	.03	.09	.19	.17	.13	.76**					
14. T2 Decision-making	4.00	.57	.41**	−.04	.09	.53**	.20	.06	−.07	.09	.08	.13	.13	.72**	.84**				
15. T2 Communication	4.09	.67	.34**	−.002	.18	.62**	.12	.15	−.03	.03	.04	.20	.07	.80**	.78**	.84**			
16. T2 Fatigue management	3.97	.72	.28*	.21	.15	.50**	.17	.06	.06	.02	.20	.26	.12	.70**	.61**	.64**	.74**		
17. T2 Safety compliance	4.26	.50	.35**	−.18	.05	.38**	.25	.35*	.12	.29	.22	.27	.19	.48**	.54**	.58**	.64**	.42**	
18. T2 Safety proactivity	4.09	.59	.29*	.03	.002	.34**	.02	.16	.11	.22	.21	.21	.25	.51**	.60**	.59**	.68**	.48**	.66**

N = 45–102.
Gender: 1 = Female, 2 = Male.
Migrant : 1 = Migrant, 2 = Non-migrant.
Country: 1 = Italy, 2 = Spain.
*$p<.05$, **$p<.01$.

Research question 1: Did trained workers appraise the training positively in terms of (a) the training structure, (b) the trainers' ability to engage workers and convey training material and (c) training methods supporting learning?

Interviews revealed an overall positive reaction to training. Trained workers thought the training was well-structured and topics were interesting and relevant: "In my opinion, the training was well organised and the topics were interesting" (Worker 5N). They also reported that trainers made training a pleasurable experience, and that trainers were knowledgeable and receptive to trainees: "It was easy to attend the training because the trainers were good and listened to us" (Worker 9M). Concerning the material itself, the material was well-received and both activities and taught material (PowerPoint slides) were viewed positively: "I like the slides, the videos and the trainers" (Worker 7M), "I am satisfied, I liked the course, especially the trainers and the activity" (Worker 10M). Workers also reported they found the online material useful: "Very good course because we had to go to the website and see all the videos and the pictures, and I really liked this about the course" (Worker 11M).

Research question 2a: Did trained workers report learning (a) technical skills, i.e. the acquisition of skills concerning mechanical, electrical, equipment, physical, chemicals, goods handling risks, and use of PPE?

To answer RQ 2, we tested trained workers' skills and knowledge about technical safety skills. We analysed the number of correct answers to the part of the knowledge test that concerned technical skills and workers interviews. We found that workers significantly improved their technical skills. Linear mixed model analysis conducted on both Spanish and Italian samples ($N = 84$) revealed a significant difference between knowledge test scores pre-training ($M = .64$, $SD = .15$) and post-training ($M = .76$, $SD = .18$), indicating that test scores increased after training (change = .12, $F = 141.33$, 95% CI [−.21, −.15]).

In interviews, workers reported they had learned technical skills. Correct use of PPE was the main technical skill trained workers remembered learning about: "I learned how to work with safety, with helmet, with shoes and all that" (Worker 14M), and "The main things I learned was non-technical skills and PPE" (Worker 7M). Other examples of technical skills learned were also reported, including the difference between risks and hazards: "The training has helped me to better understand the difference between hazard and risk and to manage them consciously" (Worker 5N), and working at heights and ergonomics: "I learned a lot, for example working safety at heights. I have learned many things concerning safety. How to work safely, for example, carrying weights with good posture … working with protection, with masks and gloves" (Worker 11M). Workers also remembered learning about signage and expiry dates of PPE: "I remember the signage, when we saw this theme, I remember the signs, the forms, the colours and what they mean. I also remember the types of PPE that you have to use when doing a specific dangerous work, whether it is masks or coveralls or expiration dates" (Worker 13N).

Research question 2b: Did trained workers report learning NTS, i.e. situational awareness, decision making, teamwork, communication, and stress and fatigue management?

Interviews revealed that workers had learned NTS, in fact, many workers reported that the key learning they had taken away from the course was the NTS, and that they had not studied these skills in other courses they had attended before: "The main thing I learned was non-technical skills" (Worker 9M). Some mentioned the terms used to describe NTS:

"I learned the non-technical skills that I didn't know before, like teamwork, communication and situational awareness" (Worker 4N), while others described the type of NTS without directly using the term, e.g. teamwork: "I learned a lot of things about safety that I didn't know and I have to pay attention about my safety and my colleagues' safety" (Worker 10M). More concretely, workers reported that they had become more safety aware, and realised that safety was a joint responsibility: "The most important skill learned is how to take care of each other, which is key to a good safety climate. I learned to take care of myself and care of my colleagues" (Worker 1M), "I learned that we are all important in ensuring construction site safety" (Worker 5N). Other workers reported they had learned about situational awareness: "Working in teams, the awareness, all these important subjects that you have to pay attention to in connection with safety. From the training we did, perhaps what I remember best are the exercises we did to create awareness of people to use PPE and the collective safety elements" (Worker 25M).

Research question 3: To which extent did trained workers perceive skills and knowledge to be applicable in the construction site?

Trained workers reported that the learning from the training course could be translated directly into safety behaviours on the construction site without much adaptation: "Right now, all that I have learned and I could get going, I did get going" (Worker 16N), and "What I have used? Pretty much everything straight to the letter" (Worker 20N). Workers also emphasised that the skills learned could be used across construction sites, be they small or large sites. Many workers had changed sites two or three times in the follow-up period, but reported that the safety issues were the same across sites: "The construction sites you go to, whether they are small or large, the safety issues are always the same, more or less" (Worker 22N).

Research question 4a: Did workers report engaging in behaviours relating to technical skills at the construction site?

In response to research question 4a, we found a significant decrease in safety compliance between Time 1 ($M = 4.46$, $SD = .66$) and Time 2 ($M = 4.26$, $SD = .59$) ($F = 4.38$, 95% CI [.01, .33]).

In interviews, most workers reported that they had transferred technical skills to the workplace and started to work more safely, in particular, using the PPE and using it correctly: "After training I remember to use the right PPE every time I need it" (Worker 10M) and another worker reported in more detail: "Now I always wear high visibility trousers and jacket, helmet, ear defender and glasses when needed. I try to wear all the PPE that I need" (Worker 4N).

Research question 4b: Did workers report engaging in behaviours relating to NTS at the construction site?

Contrary to our expectations, analyses showed a decrease in teamwork, situational awareness, decision-making, and communication. There were no significant changes in fatigue management. Please see Table 3 for a summary of analyses.

In interviews, workers reported that they had translated NTS into safety behaviours in the construction site: "What I have used the most is awareness and communication" (Worker 13N), "Before I didn't pay attention to safety, I never saw the risks and the truth is that in the workplace, they exist everywhere" (Worker 25M), "Let's see, the communication topic was very good, that is the most relevant thing that I would highlight

Table 3. Linear mixed model analysis of technical and non-technical skills pre- and post-training (N = 45).

	T1		T2				
	M	*SD*	*M*	*SD*	Change	*F*	95% CI
Teamwork	4.45	.60	4.23	.61	−.22	5.48*	.03, .42
Situational awareness	4.51	.59	4.09	.65	−.42	21.47***	.25, .64
Decision-making	4.40	.65	4.00	.57	−.40	19.15***	.24, .65
Communication	4.35	.67	4.09	.67	−.26	5.94*	.05, .50
Fatigue management	4.20	.83	3.97	.72	−.23	3.49	−.15, .46
Safety proactivity	4.24	.90	4.09	.59	−.15	1.95	−.07, .37
Safety compliance	4.46	.66	4.26	.50	−.20	4.38*	.01, .33

T1 = Time 1; T2 = Time 2.
*$p < .05$; **$p < .01$; ***$p < .001$.

that we learned. In the construction site, we have foreign people and we communicate well. So far, I have not had any problem, although new things are learned every day" (Worker 19N).

Specifically, one worker provided an example of stress management, fatigue, and teamwork: "For example, a little while ago, a colleague was very stressed out and he got into an argument with another colleague. But on the day, I was able to calm him down and I sent him home" (Worker 16N).

Research question 5: Did trained workers report higher levels of safety proactivity post-training and were there wider results of training in the construction site beyond the expected outcomes such as assertiveness?

To test the wider impact on the construction site, we tested for increases in safety proactivity, i.e. trained workers proactively pointing out unsafe practices. We found no significant change in safety proactivity between Time 1 ($M = 4.24$, $SD = .93$) and Time 2 ($M = 4.09$, $SD = .59$) ($F = 1.95$, 95% CI [−.07, .37]).

Despite this result, workers reported in interviews that they had become more aware of the importance of teamwork and their role in promoting safety. This had had an impact on colleagues' safety behaviours: "I think that in these 6 months there has been more awareness. We have usually practiced it, but now, more than ever. I always encourage and correct my colleagues about all the safety measures that we have learned, emphasising the contents that we have learned during training. They used to not use a helmet regularly but now that I have told them, they always use it because they have become aware, especially regarding the use of PPE" (Worker 21N).

Trained workers reported being more assertive in refusing to supervisors' demands to ignore safety: "The boss always used to say that we have to do things faster, that we should not turn off the machinery. But now, I stop and I say no, because of safety issues" (Worker 25M). One worker gave an example of how they had engaged in on-the-job training to support the new worker adopting safe working practices: "I have only had one new colleague and I am bombarding him a lot with safety, so much so that if he attends the course, he will pass it for sure! He is also very concerned about these issues. And the rest of the colleagues have also attended the course, so we have integrated it" (Worker 16N).

In interviews, trained workers also reported that, not only had workers become more proactive in addressing safety issues they observed in the workplace, they also reported that safety climate had changed. One worker reported changes in how workers supported

each other: "In construction it is better working together, because working as a team makes things better and there is less fatigue. Moreover, for example, a colleague says: put on your gloves … so safety is more on the agenda" (Worker 17M).

Another worker accounted how the training had changed the way the team worked together: "We talk to the team before doing the work and especially about safety issues and PPE. Let's see, there are many things that I already did, but now I talk more with colleagues about risks and things like that (for example Covid-19). We try to be more conscious, to be mindful, look at the risks and protect myself and my colleagues. For example, before sometimes we did not delimit the work areas, and now we always do it together and look more at the tools … " (Worker 18N). One worker simply put it: "We do more team work and we communicate more" (Worker 8N). Another worker gave the following example: "All the safety norms are being met. No matter how small they are, when someone does something improper and puts the team at risk, any colleague will let him know. We help each other. For example, if we go to the van, and we all have the mask and there is one who does not have the mask, then he is given a new mask. Because it is life, and you have to take care of it" (Worker 15M).

Research question 6: How did supervisors and peers facilitate or hinder training transfer?

Very few trained workers reported resistance from colleagues when they were corrected on safety behaviours. While a few were met with indifference, trained workers reported an overall positive response from colleagues, which in turn positively influenced safety climate: "They (colleagues) had a positive reaction, we talked about the knowledge that I learned during the training. Yes, since we talked, we work more safely" (Worker 2M).

We interviewed supervisors three months after workers had completed training and we interviewed workers six months after training about the reactions of supervisors. We chose to interview both parties to triangulate the experiences of workers of the support they and to gain insights into the support strategies of supervisors. Supervisors reported being supportive of workers applying skills and knowledge acquired during training. We asked them to rate themselves on the extent to which they: had talked to trained workers about safety after they had returned form training; had established concrete actions to support training transfer; had given them specific instructions on how to work safely; provided them with PPE to work safely; and recognised their efforts to apply skills and knowledge learned during training. With few exceptions, supervisors reported they had done so to a large or a very large extent. Supervisors gave several examples of these practices, especially they reported they had discussed with trained workers what they had learned: "After training, we always talk together about what they (trained workers) learned" (Supervisor 10), and "We have commented many times on the course. I have asked them, hey what's new, so that they can tell me things I don't know and put them into practice" (Supervisor 11).

Supervisors also reported that trained workers had been given tasks to practice specific safety behaviours: "I have given him tasks in the construction site to apply what he had learned" (Supervisor 15). Supervisors also reported making sure workers had the necessary equipment to apply knowledge about PPE acquired during the course. "We have given them boots, helmets, and all the necessary PPE" (Supervisor 18). Supervisors,

however, were also aware of the PPE: "We don't only talk about PPE, but also collective safety measures such as ladders and scaffolding, and platforms" (Supervisor 13). Supervisors also highlighted how they facilitated safety discussions in the planning of the work to be completed: "We talk about the plan for the day, what we need to do before we start the day's tasks, seeing what could be the challenges of the work. We revise the harnesses, the ropes, and all the material" (Supervisor 13). Finally, supervisors expressed the expectation that trained workers were proactive in taking the lead for safety in the construction site: "They [workers who had completed the course] have to warn me if someone does not comply with the rules, in case I did not realize … They are the first to tell me: hey, what do we need to do with this? And I say: What do you need? Is it in the store? Well, you have to go for it!" (Supervisor 16).

With few exceptions, trained workers reported they had felt supported by their supervisors once they returned to the construction site, and also recounted similar strategies mentioned by supervisors in terms of encouraging workers to use training and share knowledge with colleagues who had not been on training: "Yes, they had a positive reaction, they listen to me when I talk about my experience with the training. Yes, they encourage me to use the knowledge and share it with my colleagues" (Worker 4N). One trained worker reported that the owner of the small company respected the knowledge he had acquired doing training and now had devolved responsibility concerning safety to him: "The owner is the one who puts safety measures in place. He is very positive. Now he has explicitly given me the freedom to implement any safety measures and decide without consulting him. This is much better because in other companies, workers have to be insured and are not given the necessary resources. We have good resources. I coordinate with the owner, we have a meeting in the morning and we agree on what to do" (Worker 21N).

Additional analyses

Our additional pandemic questions revealed that, when asked about their employment status during lockdown, 40.4% of trained workers reported working the same amount as they had before lockdown (of these, 36.8% were migrants), while only 4.3% reported working more than usual (of these, none were migrants). A majority of participants, however, reported working less than they would have prior to lockdown, with 29.8% reporting not working at all (of these, 47.6% were migrants).

Discussion

In the present study, we employed a mixed methods, before-and-after study design to evaluate the extent to which trained workers reacted positively to the training, reported they learned something from the course, were able to transfer learning to the construction site and whether changes in safety behaviours and wider results could be observed.

In response to RQ1, training was effective at Kirkpatrick's (1994) first level in that workers reacted positively to training. They enjoyed the material and felt the trainers did a good job. In relation to the training transfer literature (Burke & Hutchins, 2007), we found that positive reactions to the structure of the training, the training methods

and materials, and to the trainers conducting the training, were are all considered to be important factors for training transfer.

In response to RQ2, Kirkptrick's learning level, knowledge tests revealed a significant increase in trained workers' technical safety knowledge. This was confirmed in interviews, where use of PPE was reported most often. One possible explanation is that, while other technical skills (e.g. falling form heights) depend on the type of work carried out onsite, all workers must wear PPE. NTS learning was evidenced as trainees were able to name NTS and provide examples of them. Most trainees mentioned NTS as their key learning. A possible explanation may be that most safety training to date has focused on technical skills; thus, NTS were something workers had not encountered before this training. That workers put such emphasis on learning NTS indicates that workers are able to learn abstract skills (De Souza et al., 2012). The seminal training transfer model by Baldwin and Ford (1988) identified learning as in important precursor to training transfer.

In relation to RQ3, exploring how easy trained workers found it to translate skills and knowledge into safety behaviours in the workplace without much adaptation, we found that workers did not report difficulties translating skills. This result indicates that the methods of learning and the very practice-oriented exercises had been effective. Nielsen et al. (2021) argued that an important missing link in the existing training transfer and effectiveness literature is the evaluation of whether skills and knowledge are easily adaptable to the work context. In this respect, our study is an important contribution as we found that trained workers found skills and knowledge to be easily translated into the construction site.

In terms of RQ4, we found either no significant results or significant decreases in our quantitative analyses. These results are contrary to what we hypothesised and go against our qualitative results and what we would expect based on the results of the knowledge test, which found trainees' had learned new skills. A possible explanation is that, as many workers were unemployed at the time of follow-up due to lockdowns, they were unable to answer questions about which safety behaviours they engaged in. In interviews, workers were asked to give examples of what safety behaviours they had engaged since training, and here we found a more positive picture. Trained workers reported they had both been more compliant using PPE and applying safety skills, and they also reported they had translated NTS into actual safety behaviours in the workplace. It is encouraging that trained workers reported using both technical skills and NTS and that trained workers reported engaging in abstract thinking to identify safety risks and make decisions on how to minimise these risks. In conclusion, we find some encouraging results in the interviews, but we cannot definitely conclude that the training programme was effective at the fourth level of the Kirkpatrick model, behaviours as the survey results did not find improvements in safety compliance and NTS; in fact, we mostly found decreases in these outcomes.

In terms of wider results, our fifth research question, regarding Kirkpatrick's fourth level of results, we found no significant improvement in safety proactivity. However, this may again be due to many workers no longer working in construction due to the pandemic. We did find in interviews that workers reported increased assertiveness. Previous studies have found less encouraging results: Williams et al. (2010) and Menzel and Shrestha (2012) did not find much improvement in assertiveness, although Forst et al.

(2013) and Jaselskis et al. (2008) found workers described they did engage in assertive behaviours.

In relation to our sixth research question, we found that trained workers reported that colleagues and supervisors were mainly supportive of trained workers transferring safety skills and knowledge into safety behaviours in the workplace. Our results are encouraging and seem to contradict concerns in the existing safety training literature of migrant construction workers who found that performance was often prioritised over safety (Brunette, 2005; Choudhry & Fang, 2008), that supervisors put additional pressure on migrant workers, and that communication was often poor between supervisors and migrant workers (Brunette, 2005). Our results are in line with previous training transfer literature emphasising the importance of peer and supervisor support for training transfer (Blume et al., 2010; Burke & Hutchins, 2007).

Implications for research

Our study has important implications for theory and methods. We tested all four levels of outcomes of the Kirkpatrick training evaluation model (1994), thus extending previous evaluation of safety training (Peiró et al., 2020). Evaluating all four levels is crucial to understand at which level training is effective and brings about intended outcomes. We integrated the training transfer and training effectiveness models (Baldwin & Ford, 1988; Kirkpatrick, 1994) and found support that our training content did not require much adaption to translate skills and knowledge learned during training into changed safety behaviours. The low level of adaptation and translation needed may be an important mechanism explaining why acquired learning leads to changes in safety behaviours.

Our study has important implications for mixed methods research. We found conflicting results of our data triangulation with regards to NTS, safety compliance, and proactivity. In our before and after survey, we found no significant increases; instead, we found significant decreases in communication. There are three possible explanations for this. First, our sample size was relatively small and therefore we may have insufficient power to detect significant differences. Second, our scales may not be sufficiently sensitive to capture the nature of technical skills and NTS (Gupta et al., 2018). Third, the non-significant results and the decrease in communication could be due to the fact that many workers were out of work. In our follow-up survey, 29.8% of workers were out of work and many interviewed workers reported they no longer worked in the construction sector. As many construction sites had been closed, workers found employment in other sectors, such as food service and delivery. Our results call for alternative methods of data collection during these challenging times to evaluate outcomes of interventions. Our results indicate that the picture may be more complicated and that qualitative data may provide richer insights into what has changed. Furthermore, mixed methods allow for the exploration of positive side effects. We found qualitative accounts of safety proactivity, assertiveness, and safety climate despite these not being explicit outcomes of the training.

Practical implications

Our study carries important practical implications. First, our research calls for organisations and training providers to train migrant and native workers together, and develop training

using methods that encourage participation and learning through sharing real-life experiences. Second, to ensure training relates as much as possible to the real situation in the construction site, it may be important to educate trainers on the special needs of migrant workers in the construction industry, so that they can use examples in training relevant to these workers. Third, we found that colleague support was important for training transfer, which suggests that training whole teams together may increase the chances of transfer, as it allows workers to develop a shared understanding of the importance of safety at work.

Fourth, supervisors play a crucial role in training transfer. Important strategies were that supervisors discuss what had been learned during training, encourage workers to share their safety knowledge with colleagues, set workers specific tasks that allow them to practice learned safety behaviours and make sure that workers have access to the necessary equipment to work safely. Training supervisors to promote positive safety attitudes may be an option, however, there are also wider organisational resources that should be in place. Supervisors should have the necessary financial resources to acquire necessary safety equipment. Finally, building projects should be planned to allow workers to work at a pace that enables them to work safely and take the necessary safety precautions. This includes a change in the entire industry where safety is considered as part of tenders and quality to tenders are based, not only on costs and delivery times but also on appropriate safety procedures being accounted for. Sixth, human resources should integrate safety outcomes into Key Performance Indicators (KPIs) for teams and supervisors.

Strengths and limitations

The four major strengths of the study are the evaluation of a training course in two countries, the mixed methods approach, the multi-level analysis, and the integration of training transfer and outcome evaluation. The study, however, is not without its limitations. First, despite a reasonable sample size, dropout was large. After six months, many workers were out of work due to the pandemic, which may have impacted our response rates and our statistical analyses. Importantly, workers remembered the training course in interviews and reported they had translated learned skills and knowledge into safety behavioural changes at work, even if they no longer worked or worked in different sectors. Second, we did not obtain organisational data on near miss incidents, accidents and injuries. It was not possible to obtain these metrics as workers came from many different organisations and it is unlikely that a few trained workers will have a significant impact on these figures within the organisation. Furthermore, workers in our study frequently changed jobs.

Third, it could be argued that our mixed methods approach has an overreliance of qualitative methods. For three out of four outcomes, we employed the both qualitative and quantitative methods to evaluate the effect of training at this level. It could be argued that we could have used quantitative measures to capture reaction, training transfer, and peer and supervisor support, however, due to the low literacy of trained workers, we decided to keep the questionnaires short. The qualitative approach also enabled us to provide concrete examples of peer and supervisor support and proved a useful approach in relation to the large dropout we experienced as a result of the pandemic.

Fourth, in response to RQ5, we only collected data from trained workers, not colleagues. It would have been desirable to collect data from teams to capture changes to safety climate. Unfortunately, restrictions in funding prevented us from collecting such data from colleagues who had not been on training. However, interviews of trained workers did indicate wider results in terms of improved safety climate at the construction site. As mentioned above, due to the mobility of construction workers, colleagues beyond the immediate subcontracting team often change. Fifth, also in relation to our fifth research question, we found some indications from interviews that trained workers gave examples of becoming more assertive and a better safety climate.

Sixth, we did not match the responses from trained workers and supervisors. We were able to do this but, as there was little variation in the responses from workers and supervisors, we decided not to match responses. Finally, it would have been desirable to collect data on transfer between training had been completed and our follow-up. Unfortunately, at the height of lockdown in both countries, this was not possible.

Conclusion

The main contributions of the present study are threefold. First, we presented the results of a comprehensive evaluation of an innovative safety training programme to promote technical skills and NTS in migrant and non-migrant workers demonstrating its main outcomes. Second, a systematic and theoretically grounded evaluation model was applied to integrate training transfer, context and multilevel outcomes of training. The results provided rich insights into the conditions needed for the training to be effective. Third, the use of multi-source, mixed methods made it possible to obtain information about a rich array of facets, at multiple appropriate times, and to reap the benefits of triangulation. The methods made enabled the assessment of outcomes and processes of training transfer but also side effects including understanding what occurred after the training in the work contexts. The results of this study suggest that the CSTP may ensure low-skilled workers in the construction industry learn crucial technical skills and NTS because the training enables them to translate skills and knowledge into actual changes in safety behaviours. Such transfer is enabled by a context where colleagues and supervisors support transfer.

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