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Individualized behavior-based safety-leadership training: A randomized controlled trial

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ABSTRACT

Introduction: Construction site managers play a critical role in occupational safety in the construction industry. This study aimed to develop and test a method for training construction site managers in positive feedback and active listening by incorporating the behavioral training components of behavior analysis, goal setting, practice with behavior feedback, homework, and maintenance planning into individualized behavior-based safety-leadership training (IBST), and to assess the effect of IBST on construction site managers' safety-leadership behaviors and performance. *Method*: In a naturalistic randomized controlled trial, construction site managers were randomly assigned to an experimental group ($n = 16$) or a control group ($n = 19$). The experimental-group managers received IBST, while the control-group managers received no training. Paired sample t-tests on pre- to post-training (i.e., six weeks after the final training session) were performed separately for the experimental- and control-group managers. *Results:* The safety-leadership behaviors of the experimental-group managers improved in terms of favorable feedback ($d = 0.99$, $p < .01$), safety-specific feedback ($d = 0.89$, $p = .02$), behavior-specific feedback ($d = 0.66$, $p = .02$), antecedent listening ($d = 0.68$, $p = .02$), and consequential listening ($d = 0.78$, $p = .01$). In addition, safety-leadership performance improved in terms of transformational leadership ($d = 0.78$, $p = .01$) and contingent-reward leadership ($d = 0.64$, $p = .02$). No significant change was found for the control-group managers. *Conclusions:* The results indicate that behavior analysis, goal setting, practice with behavior feedback, homework, and maintenance planning are effective behavioral training components of safety-leadership training. Positive feedback and active listening were also found to be important behavioral requisites for transformational and contingent-reward leadership. *Practical applications:* IBST can be used to develop occupational safety in the construction industry by improving construction site managers' safety-leadership behaviors and performance.

1. Introduction

Occupational accidents cause approximately 300,000 fatalities worldwide every year (Takala et al., 2017). The construction industry is one of the economic sectors most affected by occupational accidents, accounting for more than 20% of all occupational fatalities in Europe (Eurostat, 2017). Construction site managers have been identified as important leaders in the construction industry (Gravina et al., 2019; Grill et al., 2017; Grill & Nielsen, 2019), and their safety-leadership practice has been found to be associated with the safety climate (Grill et al., 2017; Hoffmeister et al., 2014), employee safety behaviors (Conchie, 2013; Conchie & Donald, 2009; Grill et al., 2017; Hoffmeister et al., 2014), and occupational injuries (Grill et al., 2017; Hoffmeister et al., 2014) at the construction site. Leadership is defined as the management of reinforcement contingencies in work settings (Podsakoff et al., 2006) and involves both antecedent and consequential leadership (Komaki, 2015). Antecedent safety-leadership behavior occurs prior to and activates employee safety behavior, while consequential safety-leadership behavior occurs afterward and reinforces employee safety behavior (Gravina et al., 2017, 2021; Grill, 2018).

1.1. Safety-leadership behaviors

Krause et al.'s (1999) meta-analysis of behavior-based safety (BBS) interventions showed that injury rates can be reduced by

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26% by applying behavior analysis (BA) (Boyce & Geller, 2001) to safety leadership. BBS interventions are based on BA and have primarily focused on reinforcing employee safety behaviors through behavior feedback (Alvero & Austin, 2004; Boyce & Geller, 2001; Gravina et al., 2019; Krause et al., 1999; Spigener et al., 2022; Tuncel et al., 2006; Weatherly & Malott, 2008; Wirth & Sigurdsson, 2008). Behavior feedback entails providing employees with information about their behavior that enables them to adjust the behavior (Sleiman et al., 2020; Weatherly & Malott, 2008). Research has found that positive behavior feedback is more effective than corrective (i.e., negative) behavior feedback (Kalata & Naugle, 2008; Sleiman et al., 2020; Turner & Leach, 2012). Effective positive feedback includes the use of specific information when describing to employees how their behaviors have contributed to fulfilling goals when they behave in accordance with rules, regulations, and agreements for performance and safety at work (Brand et al., 2020; Choi et al., 2018; Johnson, 2013; Lee et al., 2020; Palmer et al., 2015; Park et al., 2019).

Krause et al. (1999) concluded that continuous safety improvements are dependent on the involvement of employees at all levels. Active listening is a potent way to involve employees and has been found to stimulate employee well-being, satisfaction, and engagement (Arnold et al., 2000; Grill et al., 2023; Jonsdottir & Kristinsson, 2020; Newnam & Goode, 2019; Theorell et al., 2012). In the construction industry, site managers' active listening has been found to be effective in positively reinforcing employee safety behaviors (Grill et al., 2017, 2018; Grill & Nielsen, 2019; Jeschke et al., 2017). Active listening includes listening to employee views, acknowledging their input, and heeding the information and suggestions contributed by employees when solving problems and making decisions (Grill, 2018). It also involves responding to employees' ideas and suggestions on how to perform work tasks in a safe and efficient way.

1.2. Safety-leadership performance

In her meta-analysis on safety leadership, Clarke (2013) concluded that a combination of transformational and contingent-reward leadership is beneficial for occupational safety in terms of the safety climate, compliance behaviors, participative behaviors, and occupational injuries. Transformational leadership is characterized by value-based and individualized interactions with concern for employee welfare, and contingent-reward leadership implies motivationally relevant reward-for-effort exchanges based on employees' needs, desires, and individual capabilities (Zohar, 2002). However, the behavioral composite of transformational and contingent-reward leadership is still imprecise, largely because transformational leadership research habitually fails to separate behavior from the effect of behavior (Andersen, 2015; Meslec et al., 2020; Van Knippenberg & Sitkin, 2013). For example, Meslec et al. (2020) concluded that transformational leadership is defined through its outcomes or the effects leaders have on their followers. Hence, transformational leadership and contingent-reward leadership can primarily be regarded as useful indicators of safety-leadership performance (Clarke, 2013; Judge & Piccolo, 2004).

Efforts have been made to study how transformational leadership and contingent-reward leadership are enacted at construction sites by observing and analyzing the distinct behaviors of site managers (Grill et al., 2019; Oswald et al., 2022). The results indicate that active listening and positive feedback may be important behavioral requisites for achieving transformational and contingent-reward leadership (Grill, 2018; Grill et al., 2019; Oswald et al., 2022). Hence, further research is needed on the relationship between active listening and positive feedback and transformational and contingent-reward leadership.

1.3. Leadership-training research

The accumulation of research on safety leadership coincides with a growing interest in training research (Casey et al., 2021; Goldenhar et al., 2019; Martin et al., 2020; Schwatka et al., 2019, 2020; Wang et al., 2017), and many organizations spend considerable amounts of time, money, and effort on leadership training (Lacerenza et al., 2017). The way training is designed has a significant impact on its effectiveness (Casey et al., 2021); for example, Love et al. (2022) recently found that safety training needs to be face-to-face and to involve hands-on behavior rehearsal in order to be effective. Lacerenza et al.'s (2017) meta-analysis on leadership training found training to be most effective when an analysis of the pre-training need is conducted, participation is voluntary rather than mandatory, and training sessions are multiple and temporally spaced. Other important factors included training being administrated by trainers rather than being self-administrated, multiple delivery methods being combined (e.g., a mix of information, demonstration, and practice-based methods), feedback being incorporated, training being given face-to-face rather than online, and training being located on site.

However, there is a lack of randomized controlled trials (RCTs) in both occupational safety research (Nykänen et al., 2018) and leadership training research (Antonakis, 2017; Eden, 2017, 2020; Güntner et al., 2020; Lacerenza et al., 2017; Martin et al., 2020; Podsakoff & Podsakoff, 2019). In addition, many leadership-training studies use research designs that are known to overestimate the effect of the training, such as lab studies, temporary impact studies (e.g., passive scenarios and roleplaying), studies without a control group, or studies with non-random assignment to the experimental group (Martin et al., 2020; Podsakoff & Podsakoff, 2019). RCTs in naturalistic settings are needed to examine how leadership behaviors can be effectively developed through training (Antonakis, 2017; Eden, 2017, 2020; Güntner et al., 2020; Kuehnl et al., 2019; Martin et al., 2020).

1.4. Behavioral training

Positive behavioral change in leaders' day-to-day activities is a primary goal of leadership training, and behavioral measures are critical when evaluating the effectiveness of leadership training (Lacerenza et al., 2017; Salas et al., 2012). Avolio et al.'s (2009) meta-analysis on leadership development interventions indicated that interventions underpinned by behavioral principles can be more effective in achieving behavioral change than interventions based on other theoretical frameworks. Behavioral principles provide an understanding of behaviors and their topography by considering the environmental antecedents and consequences of behavior—information that enables the design of more effective interventions (Gravina et al., 2017, 2021; Grill et al., 2023; Shapiro & Kazemi, 2017).

Training based on behavioral principles typically consists of behavior analysis (BA), goal setting, practice with behavior feedback, homework, and maintenance planning (Choi & Johnson, 2022; Gravina et al., 2019; Shapiro & Kazemi, 2017; Sundel & Sundel, 2017). BA is an operant-learning operationalization of behavior that considers important and controllable contextual stimuli that are causally related to the behavioral deficits and excesses (Austin et al., 1999; Hanley et al., 2003). BA can be used to individualize behavioral training by providing individual-level information on how behavioral change can be induced. For example, Cruz et al. (2019) demonstrated that when a BA identifies a lack of positive consequences for a targeted safety behavior, consequence-based interventions are needed in order to maintain the behavior at acceptable levels, whereas added consequences

are not needed when appropriate consequences are already in place.

Goal setting can be achieved by assigning or participatively formulating goals (Ludwig & Geller, 1997). Ludwig and Geller (1997) concluded that participative goals are more effective for response generalization; that is, when individuals participate in setting behavioral goals for themselves, they increase not only the targeted behavior but also adjacent non-targeted behaviors. Considering the complexity of safety leadership, response generalization may be particularly important in leadership training. Leadership behaviors are often complex—that is, requiring elaborate problem-solving and decision-making, which influences employee behavior and work output both directly and indirectly (Binder, 2016; Gravina et al., 2017; Grill & Nielsen, 2019).

The primary learning mechanism in behavior training is to reinforce targeted behaviors by bringing performers into contact with existing natural sources of reinforcement (Choi & Johnson, 2022). Hence, by designing training so that managers can use the trained behaviors in their everyday work tasks (e.g., through on-the-job training and homework assignments; Kazantzis et al., 2010), consequent stimuli in the work environment can positively reinforce the behavior (Robinson, 2008) through instrumental (Greer, 2020) and social-positive (Beavers et al., 2013) reinforcement. Consequent stimuli that positively reinforce the trained behavior can be maximized by shaping the behavior so that it is functional in the manager's work environment (Ferguson & Christiansen, 2008; Greer, 2020; Robinson, 2008; Sundel & Sundel, 2017). Tafvelin et al. (2021) found that positive utility reactions are imperative in order for leaders to make use of their trained skills at work. Ensuring that the leadership behaviors in which managers are trained fit the environment in which the behaviors are designed to be used can be crucial for operant learning to occur (Greer, 2020).

Moreover, individualized on-the-job training that is monitored and supported by trainers enables the trainers to use behavior feedback to positively reinforce the behavior further in its natural environment (Casey et al., 2021). Komaki (1986) found that monitoring is crucial for acquiring information to enable accurate behavior feedback. In particular, work sampling (i.e., collecting first-hand information) can provide trainers with the behavior-specific and accurate information they need to provide effective behavior feedback; hence, maximizing the effect of the training (Komaki, 2015).

Once behavioral change has been achieved, some behaviors can be expected to be naturally positively reinforced, while the continuous reinforcement of other behaviors must be planned for in detail; hence, maintenance planning is an essential final component of behavioral training (Kwasnicka et al., 2016). Effective maintenance planning includes identifying high-risk situations (i.e., situations in which previous behaviors might return) and planning for the continuous generalization of the learned behavior (Kwasnicka et al., 2016).

1.5. Individualized behavior-based safety-leadership training

Safety-leadership training research in the forest industry (von Thiele Schwarz et al., 2016) revealed that managers who applied BA to their leadership practice improved their safety leadership in terms of transformational and contingent-reward leadership. Similarly, Gravina et al. (2019) outlined how BA can be integrated into the safety-leadership training of supervisors in the manufacturing industry, resulting in significant reductions in occupational injury rates. Promising results have also been reported in the construction industry, where leadership-training procedures are being developed for supervisors (Goldenhar et al., 2019; Schwatka et al., 2019, 2020), and behavioral principles are being integrated into safety-management procedures (Guo et al., 2018; Li et al., 2015; Wang et al., 2017). However, research on behavior-based safety-leadership training for construction site managers is still warranted.

Lacerenza et al.'s (2017) meta-analysis indicated that learning is more effective and enduring when it is based on the individual managers' current behavioral repertoire and contextual circumstances. One way of individualizing leadership training in behavior feedback and active listening to encompass individual and contextual circumstances is to begin the training with a thorough BA of the behaviors of the manager and the behaviors of the manager's employees (Gravina et al., 2019; Grill et al., 2023). A BA of behavior feedback and active listening leadership behaviors consists of analyzing why, how, and when the manager uses behavior feedback and active listening to augment the safety performance at the construction site. The BA shows the manager the situations in which behavior feedback and active listening can be used to activate and reinforce employee safety behaviors.

In its most basic form, a BA consists of an ABC model (Hanley et al., 2003). In an ABC model for the behavior feedback and active listening behaviors of construction site managers' safety leadership, the A stands for *antecedents* and consists of behavior feedback and active listening behaviors that are applicable to activate employee safety behaviors (e.g., organizing risk-assessment meetings in which workers are invited to describe how a work task can be performed in a safe manner). The B stands for employees' *behaviors* and consists of key employee safety behaviors (e.g., voicing suggestions on how to improve safety). The C stands for *consequences* and consists of behavior feedback and active listening behaviors that are applicable to reinforce employee safety behaviors (e.g., listening to and recognizing workers' suggestions and implementing the safety solutions identified at risk-assessment meetings). The behavior feedback and active listening behaviors identified in the ABC model as effective antecedent and consequential leadership behaviors for employee safety behaviors can then be used to formulate individualized learning objectives (cf. Ericsson, 2020), whereby the ABC model is transferred into an ABC plan for training.

If the BA that generates the ABC plan is accurately conducted, the manager will experience an increase in the targeted employee safety behaviors—an experience that will reinforce the manager's performance of the learned leadership behavior (i.e., instrumental reinforcement of the leadership behavior will have occurred; Greer, 2020). Hence, ABC plans may be used to customize the safety-leadership training of construction site managers to match the individual needs of each manager and the contextual circumstances at each specific construction site. This will increase the likelihood that the managers will experience positive utility reactions (i.e., positive reinforcement) from using behavior feedback and active listening when interacting with employees at their construction sites, ultimately resulting in enduring operant learning of the managers' safety-leadership behaviors.

The aim of the current study was to develop and test a method for training construction site managers in positive feedback and active listening by incorporating the behavioral training components of BA, goal setting, practice with behavior feedback, homework, and maintenance planning into individualized behavior-based safety-leadership training (IBST), and to assess the effect of IBST on construction site managers' safety-leadership behaviors and performance, in a naturalistic RCT. The following hypotheses were formulated:

H1. IBST improves construction site managers' safety-leadership behaviors in terms of positive feedback (H1a) and active listening (H1b).

H2. IBST improves construction site managers' safety-leadership performance in terms of transformational leadership (H2a) and contingent-reward leadership (H2b).

2. Materials and methods

2.1. Participants and procedure

The participants were recruited using a procedure designed to obtain as representative a sample as possible of the population of construction site managers. In Sweden, all construction sites are obliged to send prior notification of a new construction project to the work-environment authorities, including the contact information of the construction site manager (AFS, 1999). To enable a longitudinal research design, only managers of construction projects with a duration of at least eight months were eligible to participate in the study (the average duration of construction projects in Sweden is 10.4 months). Potential participants were identified through the work-environment authorities' notifications of construction sites and through the recruiters' personal networks. Approximately 200 site managers were contacted; 68 agreed to participate in the study and were randomly assigned to an experimental or a control group. The managers in the experimental group received IBST, while the control-group managers received no training. IBST was administered in three subsequent cohorts starting in September 2020 (cohort 1), March 2021 (cohort 2), and September 2021 (cohort 3). A block randomization procedure (i.e., with each cohort of participants being randomized separately) with slight oversampling of the experimental group (51%) was applied.

Data were collected through online questionnaires on three occasions four months apart: at randomization, pre-training, and post-training (i.e., six weeks after the final training session). Only managers who had answered the questionnaires at both pre- and post-training were included in the data analysis. In addition, the managers in the intervention group were required to have attended all five training sessions. This resulted in a total study sample of 35 managers (n = 19 in the control group and n = 16 in the intervention group). Fig. 1 provides a flow chart of the assignment, follow-up, and data analysis. Operations managers within the construction and mining sector in Sweden are 92% male, with a median age span of 45–49 years (SCB, 2022). Table 1 reports the characteristics of the managers in this study.

2.2. Primary and secondary outcome variables

2.2.1. Safety-leadership behaviors: Positive feedback and active listening

The primary outcome variables were positive feedback and active listening. *Positive feedback* was measured with three variables: a three-item scale for *favorable feedback*, adapted from Steelman et al. (2004); a three-item scale for *safety-specific feedback*, developed by the authors; and a single item for *behavior-specific feedback*, developed by the authors. *Active listening* was measured with two variables: a four-item scale for *antecedent listening*, based on Yukl et al.'s (2008) consultation scale; and a four-item scale for *consequential listening*, based on Arnold et al.'s (2000) participative decision-making scale. All items were rated on a Likert-type scale ranging from 1 (never) to 7 (always); all scales are presented in full in Appendix A.

The factor structure of the primary outcome variables was tested in accordance with conventional cut-off criteria (Byrne, 2016), using confirmatory factor analyses of the data collected at randomization (n = 68). The five-factor model (i.e., favorable feedback, safety-specific feedback, behavior-specific feedback, antecedent listening, and consequential listening) was found to represent the data acceptably well ($\chi^2_{(81)} = 125.323$; CFI = 0.901; RMSEA = 0.090) and to be superior ($\Delta\chi^2 = 130.379$; $p < 0.001$) to a two-factor model (i.e., positive feedback and active listening; $\chi^2_{(89)} = 255.702$; CFI = 0.626; RMSEA = 0.166).

2.2.2. Safety-leadership performance: Transformational and contingent-reward leadership

The secondary outcome variables were transformational and contingent-reward leadership. *Transformational leadership* was measured using six items adapted from Avolio and Bass' (2004) Multifactor Leadership Questionnaire (MLQ) (e.g., "I get others to look at problems from many different angles"). *Contingent-reward leadership* was measured using four items adapted from Avolio and Bass' MLQ (e.g., "I express satisfaction when others meet expectations"). All items were rated on a Likert-type scale ranging from 1 (never) to 7 (always). The validity of the MLQ has been established in previous research (e.g., Avolio & Bass, 2004). Table 2 shows reliability estimates, descriptive statistics, and correlations for all primary and secondary outcome variables.

2.3. Individualized behavior-based safety-leadership training

A manual for IBST was developed and used to train the managers in positive feedback and active listening (Rapp Ricciardi et al., 2023). A summary of the manual is provided in Appendix B. The IBST is based on the manual for managerial behavioral training (MBT) developed by Grill and colleagues (Björnsdotter & Grill, 2021; Grill et al., 2023). The IBST consisted of five sessions over a period of nine weeks and was carried out by the first five authors, who are licensed psychologists specialized in leadership and organizational behavior. Sessions 1, 3, and 4 each consisted of six hours of group training, while sessions 2 and 5 each consisted of three hours of individual training at the managers' construction site. A booklet was provided containing worksheets and instructions for all exercises and home assignments.

The IBST consisted of *BA*, *goal setting*, *practice with behavior feedback*, *homework*, and *maintenance planning* (Choi & Johnson, 2022; Gravina et al., 2019; Shapiro & Kazemi, 2017). The *BA* was conducted in collaboration with the managers and the trainers to identify and understand deficits in employees' safety behaviors and how these deficits were functionally related to the managers' leadership behaviors. *Goal setting* was based on the BA; each manager set behavioral (Brown & Latham, 2002; Latham & Seijts, 2016) and participative goals (i.e., agreed upon by the manager and the trainer) (Ludwig & Geller, 1997) for targeted employee safety behaviors, as well as for the functionally related positive feedback and active listening leadership behaviors of the manager that had been identified in the BA. The goals for positive feedback and active listening leadership behaviors were designed to activate and reinforce the targeted employee behaviors. The BA and the goals were combined into an individualized ABC plan (Hanley et al., 2003). *Practice with behavior feedback* consisted of behavior rehearsal (Segrin, 2008; Sundel & Sundel, 2017) in identifying key employee safety behaviors, performing BAs on key employee safety behaviors, and using feedback and active listening to activate and reinforce key employee safety behaviors. During all behavior rehearsals, the trainers provided managers with behavior feedback on their performance. *Homework assignments* (Robinson, 2008) were formulated by the managers during each session, specifying how the manager would use feedback and active listening in everyday situations at work. *Maintenance planning* included upgrading the ABC plan into a plan for how to maintain the obtained behavioral changes and independently continue behavior response generalization (Kwasnicka et al., 2016; Sundel & Sundel, 2017).

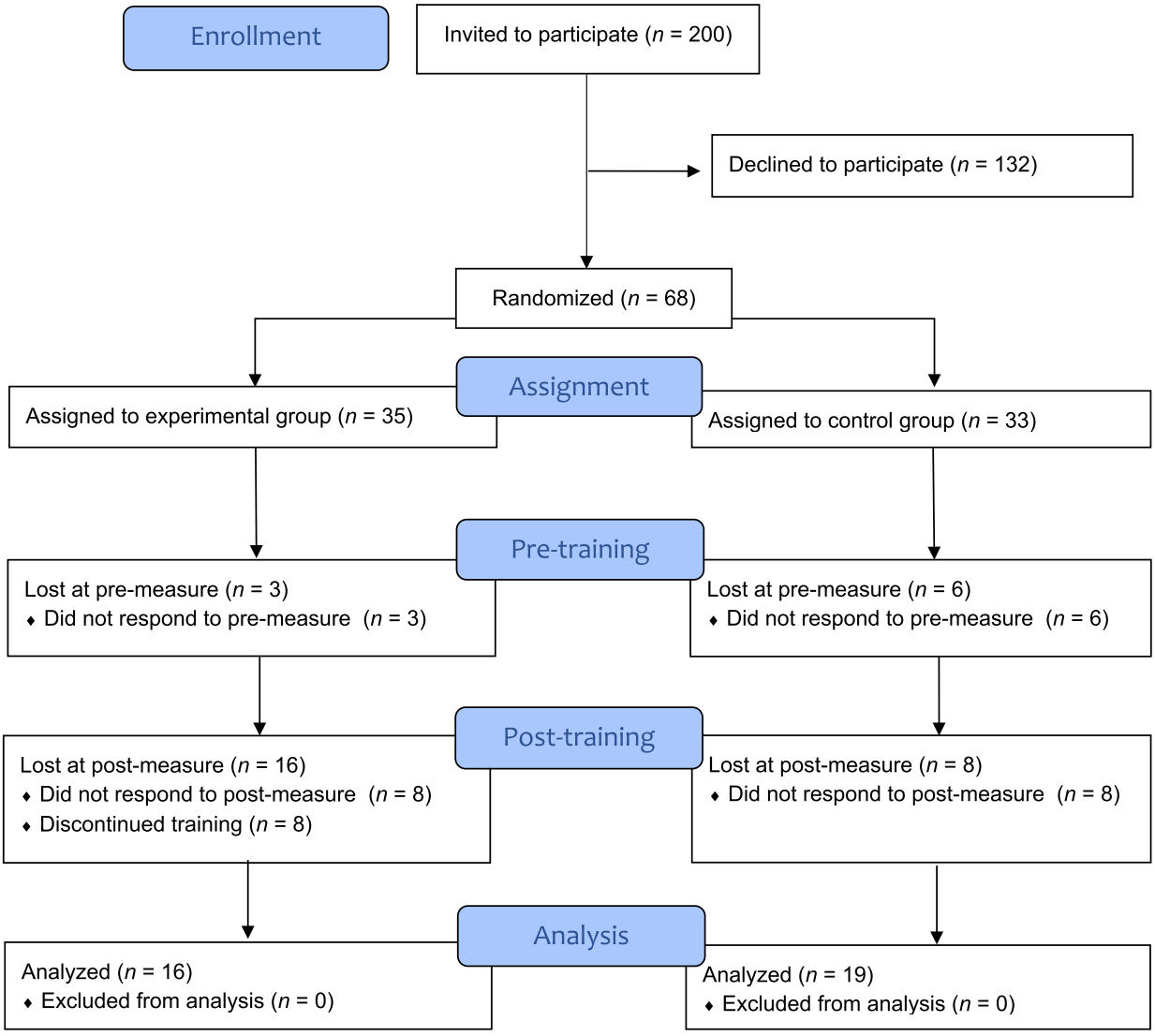

Fig. 1. Flow chart of the enrollment, assignment, follow-up, and data analysis.

The ABC plan informed all the training activities in the IBST. The training activities consisted of using the leadership behaviors specified in the ABC plan in practice—that is, in group training activities, homework assignments, and supervised individual training at the construction sites. Throughout the training activities, the managers' individual ABC plans were continuously adjusted to fit any changes in the contextual circumstances at their construction sites and to the responses the managers received from their employees while implementing the ABC plan at their construction site.

The IBST manual was developed over a one-and-a-half-year period (January 2019 to September 2020) by the first five authors in collaboration with two representatives from the construction industry, both former construction site managers—one now specialized in construction site managers' safety-leadership practice, and one specialized in leadership training of construction site managers. All components of the IBST were pilot-tested within the group prior to implementation to ensure their effectiveness. The manual ensured that the training was standardized so that all managers received the same training. However, due to the COVID-19 pandemic, only nine of the managers were able to receive their individual training face-to-face (the remaining seven had their trainers meet with them onsite via online communication solutions), and only the managers in cohort 1 had their group training face-to-face (cohorts 2 and 3 received their group training online).

2.4. Data analysis

SPSS version 29 was used for all quantitative data analysis. A randomization check was performed to ascertain that the randomization had worked (i.e., that all outcome variables were evenly distributed between the intervention and control group in pre-training), by means of independent sample *t*-tests comparing experimental- and control-group managers at pre-training. For hypothesis testing, paired sample *t*-tests on pre- to post-training data were performed separately for the experimental- and control-group managers. Effect sizes (*d*) were evaluated in accordance with the work of Cohen (1992) as small (>0.2), medium (>0.5), or large (>0.8).

2.5. Assessment of procedural integrity and utility

Assessment of the procedural integrity and utility of the IBST was done in accordance with the work of Cymbal et al. (2022) by asking the participants to answer a short questionnaire every three

Table 1
Characteristics of the participating managers and their construction sites.

	Experimental group (n = 16)	Control group (n = 19)	Total (n = 35)
Age (M/SD)	34.6/7.9	40.0/8.6	37.5/8.6
Gender (% male)	88%	95%	91%
University degree (% yes)	81%	63%	71%
OSH coordinator responsibility (% yes)	81%	90%	86%
Years of experience (M/SD)			
Managerial experience	5.9/5.4	7.6/4.5	7.6/5.0
Supervisory experience	4.5/2.7	3.0/1.2	3.0/2.3
Employment tenure	7.6/6.1	6.7/5.1	6.7/5.6
Size of construction site in SEK (Mdn)	150 000 000	150 000 000	150 000 000
Duration of construction site			
0.5–1 years	12.5%	21.1%	17.1%
1–2 years	56.3%	42.1%	48.6%
>2 years	36.8%	31.3%	34.3%
Supervisors subordinate to the site manager (n)			
0	6.3%	10.5%	8.6%
1–2	62.5%	47.4%	54.3%
3–5	31.3%	31.6%	31.4%
>5	0.0%	10.5%	5.7%
Workers employed by main contractor (n)			
0	18.8%	10.5%	14.3%
1–5	12.5%	10.5%	11.4%
6–10	12.5%	52.6%	34.3%
11–20	43.8%	26.3%	34.3%
>20	12.5%	0.0%	5.7%
Subcontractors (n)			
0–5	0.0%	10.5%	5.7%
6–10	0.0%	26.3%	14.3%
11–15	18.8%	31.6%	25.7%
16–20	25.0%	10.5%	17.1%
>20	56.3%	21.6%	37.1%
Workers employed by subcontractors (n)			
0–20	0.0%	21.1%	11.4%
21–50	18.8%	26.3%	22.9%
51–100	37.5%	26.3%	31.4%
101–200	25.0%	5.3%	14.3%
>200	18.8%	21.1%	20.0%

Note: SEK = Swedish krona (10 SEK ≈ 1 USD).

weeks on three occasions, starting three weeks after the first training session (i.e., at weeks 3, 6, and 9 of training). The extent to which participants practiced the targeted leadership behaviors in their daily work was assessed using three items (i.e., "I have activated and reinforced key behaviors according to the ABC plan," "I have performed positive feedback behaviors," and "I have performed active listening behaviors"), with five fixed-response alternatives ranging from "Never/almost never" (1) to "Always/almost always" (5). The instrumental and social reinforcement experienced by the participants when using the leadership behaviors trained at the construction site was assessed using three items on instrumental reinforcement (i.e., "When I use the behaviors that I'm learning in the safety-leadership project, this facilitates work on the construction site," "When I use the behaviors that I'm learning... this increases efficiency on the construction site," and "When I use the behaviors that I'm learning... this increases safety on the construction site"); and two items on social reinforcement (i.e., "When I use the behaviors that I'm learning... my superior manager reacts positively," and "When I use the behaviors that I'm learning... my employees react positively") with six fixed-response alternatives ranging from "Completely disagree" (1) to "Completely agree" (6).

Procedural integrity was also assessed by the trainers during the onsite individual training sessions by collecting the participants' ABC plans and by observing and documenting the participants' leadership behaviors as they implemented their ABC plans at their construction site. The observation method used was based on an observation procedure for observing and categorizing construction site managers' safety-leadership behaviors developed by Grill et al. (2019). However, instead of the eight categories used by Grill et al., the two categories of antecedent and consequential leadership of the ABC model were used to categorize the observed leadership behaviors. Fieldnotes were collected, organized, and reported in accordance with the work of Allen (2010).

3. Results

3.1. Hypothesis testing

IBST was hypothesized to improve the construction site managers' safety-leadership behaviors in terms of positive feedback (H1a) and active listening (H1b), and to improve their safety-leadership performance in terms of transformational (H2a) and contingent-reward leadership (H2b). Randomization checks showed no pre-training differences between the experimental- and control-group managers (i.e., *favorable feedback* ($t_{(33)} = 0.62$, $p = .54$); *safety-specific feedback* ($t_{(33)} = 1.02$, $p = .31$); *behavior-specific feedback* ($t_{(33)} = 1.78$, $p = .08$); *antecedent listening* ($t_{(33)} = 0.07$, $p = .94$); *consequential listening* ($t_{(33)} = 0.03$, $p = .98$); *transformational leadership* ($t_{(33)} = 0.86$, $p = .40$); *contingent-reward leadership* ($t_{(33)} = 0.84$, $p = .41$)).

The results from the paired sample t-tests are reported in Table 3 for the control-group managers and in Table 4 for the experimental-group managers. For the primary outcomes (i.e., safety-leadership behaviors), the results of the paired sample t-

Table 2
Descriptive statistics, reliability estimates (α), and correlations for all primary and secondary outcome variables pre-training.

Dependent variable	M	SD	α	1.	2.	3.	4.	5.	6.
Leadership behaviors									
1. Favorable feedback	4.41	0.66	0.91						
2. Safety-specific feedback	5.44	0.78	0.70	0.38*					
3. Behavior-specific feedback	4.60	1.29		0.29	0.51**				
4. Antecedent listening	5.46	0.88	0.91	0.14	0.45**	0.49**			
5. Consequential listening	5.46	0.74	0.78	0.15	0.32	0.07	0.44**		
Leadership performance									
6. Transformational leadership	5.41	0.58	0.77	0.49**	0.55**	0.49**	0.61**	0.33	
7. Contingent-reward leadership	5.02	0.74	0.79	0.58**	0.37*	0.28	0.14	0.19	0.60**

Notes: $n = 35$; * $p < .05$, ** $p < .01$.

Table 3
Change in leadership behaviors and performance in the control group (n = 19).

	Pre		Post		$t_{(18)}$	p	d
	M	*SD*	*M*	*SD*			
Leadership behavior							
Favorable feedback	4.47	0.59	4.60	0.41	0.98	0.34	0.23
Safety-specific feedback	5.55	0.63	5.75	0.82	1.51	0.15	0.35
Behavior-specific feedback	4.95	1.13	4.89	1.41	−0.24	0.82	−0.05
Antecedent listening	5.45	0.86	5.62	0.68	1.38	0.19	0.32
Consequential listening	5.46	0.88	5.50	0.68	0.25	0.81	0.06
Leadership performance							
Transformational leadership	5.49	0.57	5.54	0.54	0.50	0.62	0.12
Contingent-reward leadership	5.12	0.75	5.16	0.83	0.24	0.81	0.06

Note: Mean parameter values for each of the analyses are shown pre- and post-training, along with the results of *t*-tests comparing the parameters pre- and post-training.

Table 4
Change in leadership behaviors and performance in the experimental group (n = 16).

	Pre		Post		$t_{(15)}$	p	d
	M	*SD*	*M*	*SD*			
Leadership behavior							
Favorable feedback	4.33	0.74	5.02	0.69	3.97	<0.01	0.99
Safety-specific feedback	5.29	0.93	5.81	0.71	3.57	0.02	0.89
Behavior-specific feedback	4.19	1.38	5.19	0.98	2.66	0.02	0.66
Antecedent listening	5.47	0.93	6.05	0.51	2.71	0.02	0.68
Consequential listening	5.45	0.54	5.88	0.57	3.14	0.01	0.78
Leadership performance							
Transformational leadership	5.32	0.59	5.63	0.54	3.13	0.01	0.78
Contingent-reward leadership	4.91	0.74	5.34	0.57	2.55	0.02	0.64

Note: Mean parameter values for each of the analyses are shown pre- and post-training, along with the results of *t*-tests comparing the parameters pre- and post-training.

tests in the experimental group showed large effects on *favorable feedback* and *safety-specific feedback*, and medium effects on *behavior-specific feedback*, *antecedent listening*, and *consequential listening*. No effects were found in the control group. Hence, both H1a and H1b are supported. For the secondary outcomes (i.e., safety-leadership performance), the results of the paired sample *t*-tests in the experimental group showed medium effects on *transformational* and *contingent-reward leadership*. No effects were found in the control group. Hence, both H2a and H2b are supported.

3.2. Procedural integrity and utility

The results from the procedural integrity and utility questionnaire showed that most of the managers reported having activated and reinforced key behaviors according to the ABC plan at least sometimes (i.e., 100% in week 3, 87% in week 6, and 100% in week 9), and all managers had performed positive feedback and active listening behaviors onsite at least sometimes (i.e., 100% in weeks 3, 6, and 9 for both variables). All managers responded positively to the questions regarding instrumental reinforcement (i.e., 100% in weeks 3, 6, and 9 for all three variables). For social reinforcement, most managers reported having received positive responses when they used the trained leadership behaviors, both from superior managers (i.e., 81% in week 3, 93% in week 6, and 80% in week 9) and subordinate employees (i.e., 100% in weeks 3, 6, and 9).

Descriptive statistics from the procedural integrity and utility questionnaire are reported in Table 5 (no statistical tests were performed on this data). The frequency of performing the trained behaviors seemed to be constant or increasing over time: the frequency of performing the ABC plan decreased from week three to week six but returned to baseline in week nine, while the frequency of performing positive feedback and active listening showed a continued increase from week three to nine. Instrumental reinforcement seemed to be constant or increasing over time: all three variables increased from week three to six; from week six to nine, efficiency and safety remained constant, while the facilitation of work continued to increase. Similarly, social reinforcement seemed to be increasing from week three to six and, while superior reinforcement remained the same in week nine, subordinate reinforcement continued to increase. Table 6 provides the results from the onsite observations of the participants' leadership behaviors as the managers implemented their ABC plans at their construction site; three of the nine observed managers had two targeted employee behaviors each, adding up to 12 documented ABC plans.

4. Discussion

Organizations spend considerable amounts of time and money on leadership training (Lacerenza et al., 2017), while leadership-training research could benefit from more stringent studies, such as RCTs in naturalistic settings (Antonakis, 2017; Eden, 2017, 2020; Kuehnl et al., 2019; Martin et al., 2020; Podsakoff & Podsakoff, 2019). Thus, the aim of the current study was to develop and test a method for training construction site managers in positive feedback and active listening by incorporating the behavioral training components of BA, goal setting, practice with behavior feedback, homework, and maintenance planning into IBST; and to assess the effect of IBST on construction site managers' safety-leadership behaviors and performance, in a naturalistic RCT. Accordingly, a manual for IBST was developed, and its effect on safety-leadership behaviors (H1) and performance (H2) was tested. The results showed medium to large effects on safety-leadership behaviors (i.e., favorable feedback, safety-specific feedback, behavior-specific feedback, antecedent listening, and consequential listening) and medium effects on safety-leadership performance (i.e., transformational and contingent-reward leadership).

The findings indicate that IBST can be used to improve safety leadership in the construction industry, in terms of both safety-

Table 5
Descriptive statistics on procedural integrity and utility after 3, 6, and 9 weeks of training.

	Week 3		Week 6		Week 9	
	M	SD	M	SD	M	SD
Practice on site						
ABC plan	3.69	0.70	3.33	0.98	3.67	0.72
Positive feedback	4.00	0.73	4.13	0.64	4.20	0.56
Active listening	4.25	0.68	4.47	0.64	4.60	0.51
Instrumental reinforcement						
Facilitates work	4.25	0.45	4.53	0.64	4.80	0.78
Increases efficiency	4.19	0.40	4.33	0.49	4.33	0.62
Increases safety	4.75	0.68	4.93	0.80	4.87	0.83
Social reinforcement						
Superior manager	4.00	0.63	4.27	0.70	4.27	0.96
Subordinate employees	4.38	0.50	4.50	0.52	4.67	0.62

leadership behaviors and safety-leadership performance. This study therefore corroborates previous findings concerning the positive effects of behavioral-based safety-leadership training on occupational safety in the forest industry (von Thiele Schwarz et al., 2016) and manufacturing industry (Gravina et al., 2019). Similar to the training reported by von Thiele Schwarz et al. (2016), the behaviors trained in the IBST were not exclusively related to safety; on the contrary, BA, positive feedback, and active listening are generic leadership behaviors that can be applied to various organizational goals. von Thiele Schwarz et al. (2016) found the effect of behavior-based leadership training on safety performance to be the same—or even larger—when focusing on non-safety-specific leadership behaviors rather than on safety-specific leadership behaviors. Interestingly, IBST had its largest effects on favorable feedback (d = 0.99) and safety-specific feedback (d = 0.89). The former is a non-safety-specific behavior, while the latter is safety-specific. Like the training reported by von Thiele Schwarz et al. (2016), IBST seems to improve both generic and safety-specific leadership behaviors.

The results indicate that training managers in positive feedback and active listening also improve their transformational and contingent-reward leadership. The effects of IBST on transformational and contingent-reward leadership were of comparable size (d = 0.64–0.78) to its effects on positive feedback and active listening behaviors (d = 0.66–0.99). This result corroborates previous findings by Grill et al. (2019) and Oswald et al. (2022), indicating that positive feedback and active listening may be important behavioral requisites for transformational and contingent-reward leadership.

A core ingredient of the IBST was that experts in behavioral psychology trained the managers to conduct BAs of key employee safety behaviors and to use positive feedback and active listening as contingent reinforcers to improve key employee safety behaviors. The reciprocal relationship between analyzing employee behavior and training leadership behaviors functionally related to the employee behavior helped to shape leadership behaviors that were then functional at the managers' construction sites. Similarly, Tafvelin et al. (2021) recently reported that positive utility reactions were essential for leaders to make use of their trained skills in their work. Hence, ensuring that the trained safety-leadership behaviors fit the environment in which the behavior is to be used is a critical factor for operant learning to occur (Boyce & Geller, 2001).

A novel feature of the current study was its inclusion of a procedural integrity and utility assessment. Procedural integrity refers to the extent to which an intervention is implemented as prescribed; it assists in verifying that the independent variables—and no extraneous variables—are responsible for the intervention effects (Cymbal et al., 2022). The procedural integrity and utility data in the current study showed how the training was experienced and implemented by the managers, and the results indicate an ascending learning curve. This result aligns with previous research on shaping (Ferguson & Christiansen, 2008); that is, behaviors are gradually shaped to be functional in the environmental context in which they are used. Shaping implies that an increase in contextually functional behaviors coincides with an increase in the instrumental (Greer, 2020) and positive social (Beavers et al., 2013) reinforcers of the behaviors in the environment. Hence, shaping may have constituted an important learning mechanism in the IBST.

The results from the procedural integrity and utility assessment also revealed how the managers implemented positive feedback and active listening (i.e., how they implemented their ABC plans at their construction sites). The safety-leadership behaviors observed among the managers during the individual training sessions corresponded well with the positive influence categories of the direct and indirect safety-leadership practices identified by Grill and Nielsen (2019)—that is, sequencing of work tasks, planning of the physical layout of the site, ensuring safety-related meeting structures, ensuring appropriate safety aids and resources, planning safety work procedures, ensuring safety introductions, and identifying and correcting safety risks (e.g., by increasing involvement and issuing directives). Hence, positive feedback and active listening leadership behaviors were not performed in isolation but fully integrated into the managers' everyday safety-leadership practice.

5. Methodological considerations and future research

Insufficient statistical power due to the small sample size precluded testing for interaction effects (e.g., interaction between condition and time), thus preventing more elaborate statistical comparisons between the experimental- and control-group managers. Also, the small sample size makes it difficult to assess how representative the managers in this study are of the larger population of construction managers. However, the recruitment procedure was designed to obtain a sample as representative of construction site managers as possible, and the characteristics of the participating managers and their construction sites do not deviate from the characteristics of the larger population of managers and construction sites within the construction industry in Sweden. Nonetheless, the efficacy of IBST merits further research to establish its generalizability.

In accordance with previous training research, the IBST was designed to consist of both face-to-face group training and onsite face-to-face individual training. However, due to the COVID-19 pandemic, only 56% of the managers were able to receive their individual training face-to-face (the remaining 44% had their trainers meet with them onsite via online communication solutions),

Table 6
Results from the observations of how the managers implemented their ABC plans at their construction sites.

Manager no.	Antecedent leadership behaviors used to activate targeted employee behavior	Targeted employee behavior	Consequential leadership behaviors used to reinforce targeted employee behavior
1	Held a meeting in which the supervisors were asked to describe how they carried out safety introductions, and one supervisor was asked to perform a role play in which he was trained in relevant behaviors to perform an effective safety introduction.	Supervisors give effective safety introductions to all workers upon arrival at the site.	Participated in a safety introduction; afterward, described to the supervisors how their way of conducting the introductions contributed to site safety performance. After subsequent safety introductions, the supervisors were asked to describe how they behaved and were given feedback on the behavior.
1	Asked each subcontractor to assess how much time they needed to complete work on each floor in a high-rise building and used their assessments to provide all subcontractors with a timetable for when they were to start and finish work on each floor.	Sequencing work so that one subcontractor is finished working on a floor and has it cleaned before the next subcontractor begins work on that floor.	Held meetings on the floor with each subcontractor on the day they were to have finished work on that floor, giving them positive feedback on performance and cleaning.
2	Introduced a recurrent agenda item called "coordinating work environment" at the weekly production meetings with the subcontractors.	Subcontractors voicing safety issues.	Maintained eye contact with the subcontractors when they voiced safety issues, gave positive feedback describing how the safety issues voiced by the subcontractor contributed to site safety performance, and took action to address the safety issues raised by the subcontractors. Safety issues addressed in this way included lack of recycling bins, dust traps, covering up material at the end of the working day, and removal of surplus material.
3	Held meetings with workers to inform them how to document and correct safety hazards by taking pre- and post-pictures of the hazards and sending them to the site manager. In addition, the same information was posted on signs all around the site.	Workers documenting and correcting safety hazards.	Gave positive feedback when pre- and post-pictures were sent to the manager; safety issues addressed in this way included cleaning, putting up safety barriers preventing falls from a height, using a safety harness when disassembling scaffolding, and putting up safety barriers to protect the public.
4	Held morning meetings in which all workers were asked to describe the work task of the day and the safety equipment they needed to do the work task.	Workers planning to use the correct safety equipment.	Maintained eye contact and asked follow-up questions on the safety equipment and on when and how the worker was going to perform the work task.
5	Held a meeting in which the supervisors were asked to describe and demonstrate how they carry out work preparation meetings and the technical tools they use for organizing and documenting work preparation meetings.	Supervisors carrying out work preparation meetings in which safe behaviors are specified.	Gave positive feedback describing how the way the supervisors carried out work preparation meetings contributed to safe work behaviors being specified. Used suggestions from the supervisors when deciding on how work preparation meetings were to be performed henceforth, including what technical tools to use.
6	Held a meeting informing the supervisors about the safety measures needed for lifting heavy materials, including safety barriers. Implemented morning meetings led by the supervisor immediately prior to each lift in which the supervisor described how safety measures, including safety barriers, were to be set up.	Supervisor putting up safety barriers when performing weekly lifts of heavy material.	Participated during a lift, took photos, and gave the supervisor positive feedback on how the safety barriers had been put up. At the following production meeting, used a map to show the larger team how the supervisor had organized safety around the lift, including the safety barriers, and gave positive feedback to the supervisor in public.
6	Asked the workers about what they needed in order to put surplus material and waste in place and acted on their input by reorganizing the workplace disposition plan so that waste bins were placed more conveniently.	Workers putting surplus material and waste in order.	Did rounds on the site and gave positive feedback to workers that had placed surplus material and waste in order.
7	Held a meeting with workers not fully complying with wearing helmets and safety vests on site and asked them to describe their use of PPE.	Workers using helmets and safety vests on site.	Monitored the use of helmets and safety vests for two weeks and gave positive feedback to the workers every time they used a helmet and safety vest, emphasizing their contribution to site safety performance and their function as role models for younger workers.

(*continued on next page*)

Table 6 (*continued*)

Manager no.	Antecedent leadership behaviors used to activate targeted employee behavior	Targeted employee behavior	Consequential leadership behaviors used to reinforce targeted employee behavior
8	Attended a safety round demonstrating to the supervisors how to use active listening and feedback to subcontractors to stimulate the subcontractors' voicing behaviors.	Supervisors using active listening and positive feedback to stimulate subcontractors to voice safety issues during safety rounds.	Attended a safety round and monitored the supervisors' active listening and feedback behaviors. After the round, the supervisors were given positive feedback on their active listening and feedback behaviors. During weekly meetings with the supervisors, asked them to describe the previous safety round and their use of active listening and feedback to subcontractors during the round. Gave positive feedback on supervisors' active listening and positive feedback behaviors.
9	Asked workers to describe their use of a mobile application for reporting incidents. Let workers demonstrate the application to each other.	Workers reporting incidents using the mobile application.	Provided weekly updated visual feedback on the number of incidents reported in the mobile application.
9	Informed the supervisors why and how to give positive feedback. Discussed the supervisors' positive feedback behaviors with them.	Supervisors giving workers positive feedback on safe behaviors.	Held weekly follow-up meetings on feedback behaviors during which the supervisors were asked to describe the feedback behaviors they had used during the last week. The supervisors were given positive feedback on their positive feedback behaviors.

and only the managers in cohort 1 (i.e., 31% of the managers) had their group training face-to-face (cohorts 2 and 3 received their group training online). Sensitivity analyses indicated that the effect of the training was marginally (statistically non-significant) larger for the managers who received their individual training face-to-face. However, the small sample size precludes any robust analyses and hence it is undetermined whether training setting moderates the effects of IBST.

Changes attained through interventions based on behavioral principles tend to be enduring and long-lasting, because individuals usually continue to generalize learned functional behaviors (Beesdo-Baum et al., 2012; Krause et al., 1999; Kröger et al., 2015; Lopes et al., 2014; von Brachel et al., 2019). For example, Krause et al. (1999) found that behavior-based interventions caused injury rates to decrease by 26% on average during the first year, while the annual decrease in injury rates reached 69% in the fifth year. In the current study, the post-training effects were measured six weeks after the final training session, indicating enduring medium-term effects. However, follow-up measures are needed to assess the extent to which IBST induces long-lasting behavior changes.

6. Conclusions

In this study, IBST was found to improve construction site managers' safety-leadership behaviors in terms of positive feedback and active listening. More specifically, medium to large effects were detected for favorable feedback, safety-specific feedback, behavior-specific feedback, antecedent listening, and consequential listening. Training managers in positive feedback and active listening was also found to improve safety-leadership performance in terms of transformational and contingent-reward leadership, indicating that positive feedback and active listening may constitute critical behavioral requisites for transformational and contingent-reward leadership.

7. Practical applications

IBST can be used to develop occupational safety at construction sites by improving construction site managers' safety-leadership behaviors and performance. The results indicate that BA, goal setting, practice with behavior feedback, homework, and maintenance planning are effective behavioral training components for safety-leadership training. Hence, we encourage training professionals to include behavioral components when designing and implementing safety-training interventions.

CRediT authorship contribution statement

Martin Grill: Conceptualization, Methodology, Formal Analysis, Investigation, Writing—Original Draft, Project Administration, Funding Acquisition. **Amanda Ulfdotter Samuelsson:** Methodology, Investigation, Writing—Original Draft, Project Administration. **Erik Matton:** Methodology, Investigation, Writing—Review & Editing. **Edit Norderfeldt:** Methodology, Investigation, Writing—Original Draft. **Max Rapp-Ricciardi:** Methodology, Investigation, Writing—Review & Editing. **Christine Räisänen:** Methodology, Writing—Review & Editing. **Pernilla Larsman:** Methodology, Formal Analysis, Investigation, Writing—Original Draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Questionnaire items for the primary outcome variables

Rate how frequently you perform the following behaviors using this rating scale: 1 = never, 2 = almost never, 3 = occasionally, 4 = sometimes, 5 = often, 6 = almost always, and 7 = always.

Leadership behavior	Item
Favorable feedback	I give positive feedback to my employees when they perform well I let my employees know when they have done a good job I give regular positive feedback to my employees
Safety-specific feedback	I give positive feedback to my employees when they inform me about safety risks at work I give positive feedback to my employees when they suggest ways to improve safety at work I give positive feedback to my employees when they work in accordance with safety rules and regulations
Behavior-specific feedback	When I give positive feedback to my employees, I specify which behaviors I appreciate
Antecedent listening	I ask employees to voice suggestions on how to improve work procedures I ask employees to voice ideas on work planning I encourage employees to voice any work-related concern I encourage employees to voice suggestions for organizational improvements
Consequential listening	I listen to employees' ideas and suggestions I use my employees' suggestions when I make decisions that affect them I respond to my employees' ideas when I disagree with them I make decisions based exclusively on my own ideas (reversed)

Appendix B. IBST

IBST is designed to optimize the learning of positive feedback and active listening leadership behaviors. The training consists of conducting behaviors analyses (BAs) to identify the functional relationship between managers' leadership behaviors and their followers' behaviors—information that is then used to create individualized ABC plans for how each manager can use positive feedback and active listening leadership behaviors to increase that manager's employees' safety performance.

Session 1 is a group session including lectures on BA, positive feedback, and active listening. The first session also consists of roleplay and behavioral rehearsal to practice BA, positive feedback, and active listening. First, the participants are trained to identify safe behaviors performed by employees and supervisors. Being able to define the safety culture in concrete behaviors is central to the training, and the site managers practice this throughout the session. The participants choose one or two key employee behaviors to include in their ABC plan and to focus on throughout the IBST. The goal of the training is to increase the frequency of these key behaviors, which are designed to have a positive impact on safety at the managers' construction site. If safe behaviors increase, the likelihood of incidents and accidents will decrease; for example, the risk of falling from a height when working at a high altitude will be reduced if employees always perform the following behavior: *Put on the full-body harness and anchor it to the attachment point*. The managers can choose safe behaviors such as: *My subcontractors will increase the frequency of reporting risks*, or *My [subordinate] supervisors will give more positive feedback on safe behaviors to their workers*. Next, we dig into the operant learning theory underpinning the BA. The participants receive education and training in the operant learning theory on how behaviors are activated and reinforced. Exercises in defining activators and reinforcers in everyday life are interspersed with examples from everyday life from the managers' construction sites. By the end of the first session, the participants have developed a homework assignment for themselves, consisting of an easy-to-follow ABC plan aiming to activate their own frequency of delivering positive feedback and active listening in order to activate and positively reinforce the key employee safety behaviors they identified in their BA of employee behaviors.

Session 2 consists of individual training. A trainer visits the manager at the construction site and observes the manager during interactions with employees. The trainer provides feedback to positively reinforce the managers' positive feedback and active listening behaviors in their interactions with employees. The individual training aims to support the participants during the development of new leadership skills and to support the participants in working with their ABC plan on how to improve their use of positive feedback behaviors and active listening as a tool to create a safer workplace.

Session 3 consists of group training, and the participants receive more advanced lectures on BA, positive feedback, and active listening. Session 3 also includes more advanced behavioral rehearsal and roleplay to practice positive feedback and active listening. For example, the participants learn how to use virtual graphs and storytelling as feedback tools to reinforce safe behaviors.

Session 4 consists of the final group training; to further advance the training on positive feedback and active listening, the participants also receive lectures on and training in giving corrective feedback. Along with positive feedback, an important leadership skill is to correct at-risk behaviors. For example, the participants discuss and perform their own functional BA of a situation in which a manager observes a potentially dangerous behavior and does not intervene. The participants perform BAs of the manager's and worker's behaviors to understand when and how to use positive and corrective feedback, respectively. During this session, the participants also spend time practicing positive and corrective feedback, along with active listening through behavioral rehearsal, roleplay, and group exercises. As a last exercise during this session, the participants are instructed on how to expand their ABC plan into a maintenance plan (i.e., by adding effective antecedents and consequences for the leadership behaviors they have developed in the training), to make sure that their plans are robust in maintaining their newly gained leadership skills. The trainers follow up on the participants' maintenance plan during the fifth and final session.

Session 5 consists of more individual training; for the second time, a trainer visits each manager at the construction site, observes the manager, and provides feedback to positively reinforce the manager's positive feedback and active listening behaviors in day-to-day interactions with employees. The individual training aims to support the participants during the development of the acquired leadership behavior and in working with their maintenance plan on how to continue to improve their use of positive feedback behaviors and active listening as a tool to create a safer workplace.

References

AFS. (1999). *Provisions on Safety and Health on Building and Civil Engineering Work, AFS 1999:3*. Swedish Work Environment Authority. https://www.av.se/en/work-environment-work-and-inspections/publications/foreskrifter/building-and-civil-engineering-work-afs1999-3eng-provisions/.

Allen, D. (2010). Fieldwork and participant observation. In I. Bourgeault, R. Dingwall, & R. de Vries (Eds.), *The SAGE handbook of qualitative methods in health research* (pp. 353–372). Sage.

Alvero, A. M., & Austin, J. (2004). The effects of conducting behavioral observations on the behavior of the observer. *Journal of Applied Behavior Analysis, 37*(4), 457–468.

Andersen, J. A. (2015). Barking up the wrong tree. On the fallacies of the transformational leadership theory. *Leadership & Organization Development Journal, 36*(6), 765–777.

Antonakis, J. (2017). On doing better science: From thrill of discovery to policy implications. *The Leadership Quarterly, 28*(1), 5–21.

Arnold, J. A., Arad, S., Rhoades, J. A., & Drasgow, F. (2000). The empowering leadership questionnaire: The construction and validation of a new scale for measuring leader behaviors. *Journal of Organizational Behavior, 21*, 249–269.

Austin, J., Carr, J. E., & Agnew, J. L. (1999). The need for assessment of maintaining variables in OBM. *Journal of Organizational Behavior Management, 19*(2), 59–87.

Avolio, B. J., & Bass, B. M. (2004). *Multifactor leadership questionnaire* (3rd ed.). University of Nebraska.

Avolio, B. J., Reichard, R. J., Hannah, S. T., Walumbwa, F. O., & Chan, A. (2009). A meta-analytic review of leadership impact research: Experimental and quasi-experimental studies. *Leadership Quarterly, 20*(5), 764–784.

Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty years of research on the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 46*(1), 1–21.

Beesdo-Baum, K., Jenjahn, E., Höfler, M., Lueken, U., Becker, E. S., & Hoyer, J. (2012). Avoidance, safety behavior, and reassurance seeking in generalized anxiety disorder. *Depression and Anxiety, 29*(11), 948–957.

Binder, C. (2016). Integrating organizational-cultural values with performance management. *Journal of Organizational Behavior Management, 36*(2–3), 185–201.

Björnsdotter, A., & Grill, M. (2021). *Chefshandledning: En manual till funktionellt ledarskap [Managerial behavioral training for functional leadership]*. Studentlitteratur.

Boyce, T. E., & Geller, E. S. (2001). Applied behavior analysis and occupational safety. *Journal of Organizational Behavior Management, 21*(1), 31–60.

Brand, D., Novak, M. D., DiGennaro Reed, F. D., & Tortolero, S. A. (2020). Examining the effects of feedback accuracy and timing on skill acquisition. *Journal of Organizational Behavior Management, 40*(1–2), 3–18.

Brown, T. C., & Latham, G. P. (2002). The effects of behavioural outcome goals, learning goals, and urging people to do their best on an individual's teamwork behaviour in a group problem-solving task. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement, 34*(4), 276.

Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Routledge.

Casey, T., Turner, N., Hu, X., & Bancroft, K. (2021). Making safety training stickier: A richer model of safety training engagement and transfer. *Journal of Safety Research, 78*, 303–313.

Choi, E., & Johnson, D. A. (2022). Common antecedent strategies within organizational behavior management: The use of goal setting, task clarification, and job aids. *Journal of Organizational Behavior Management*, 1–21.

Choi, E., Johnson, D. A., Moon, K., & Oah, S. (2018). Effects of positive and negative feedback sequence on work performance and emotional responses. *Journal of Organizational Behavior Management, 38*(2–3), 97–115.

Clarke, S. (2013). Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours. *Journal of Occupational and Organizational Psychology, 86*(1), 22–49.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155.

Conchie, S. M. (2013). Transformational leadership, intrinsic motivation, and trust: A moderated-mediated model of workplace safety. *Journal of Occupational Health Psychology, 18*(2), 198–210.

Conchie, S. M., & Donald, I. J. (2009). The moderating role of safety-specific trust on the relation between safety-specific leadership and safety citizenship behaviors. *Journal of Occupational Health Psychology, 14*(2), 137–147.

Cruz, N. J., Wilder, D. A., Phillabaum, C., Thomas, R., Cusick, M., & Gravina, N. (2019). Further evaluation of the performance diagnostic checklist-safety (PDC-Safety). *Journal of Organizational Behavior Management, 39*(3–4), 266–279.

Cymbal, D., Wilder, D. A., Cruz, N., Ingraham, G., Llinas, M., Clark, R., & Kamlowsky, M. (2022). Procedural integrity reporting in the Journal of Organizational Behavior Management (2000–2020). *Journal of Organizational Behavior Management, 42*(3), 230–243.

Eden, D. (2017). Field experiments in organizations. *Annual Review of Organizational Psychology and Organizational Behavior, 4*, 91–122.

Eden, D. (2020). The science of leadership: A journey from survey research to field experimentation. *The Leadership Quarterly, 101472*.

Ericsson, K. (2020). Towards a science of the acquisition of expert performance in sports: Clarifying the differences between deliberate practice and other types of practice. *Journal of Sports Sciences, 38*(2), 159–176.

Eurostat. (2017). *Accidents at work (ESAW, 2008 onwards) (hsw_acc_work)/Details by NACE Rev. 2 activity (2008 onwards) (hsw_n2)/Fatal Accidents at work by NACE Rev. 2 activity (hsw_n2_02). http://ec.europa.eu/eurostat/web/health/health-safety-work/data/database.*

Ferguson, K. E., & Christiansen, K. (2008). Shaping. In W. T. O'Donohue & J. E. Fisher (Eds.), *Cognitive behavior therapy: Applying empirically supported techniques in your practice*. John Wiley & Sons.

Goldenhar, L. M., Schwatka, N., & Johnson, S. K. (2019). Leadership skills for strengthening jobsite safety climate. *Journal of Safety Research, 70*, 263–271.

Gravina, N., Cummins, B., & Austin, J. (2017). Leadership's role in process safety: An understanding of behavioral science among managers and executives is needed. *Journal of Organizational Behavior Management, 37*(3–4), 316–331.

Gravina, N., King, A., & Austin, J. (2019). Training leaders to apply behavioral concepts to improve safety. *Safety Science, 112*, 66–70.

Gravina, N., Nastasi, J., & Austin, J. (2021). Assessment of employee performance. *Journal of Organizational Behavior Management, 41*(2), 124–149.

Greer, R. D. (2020). The selector in behavior selection. *The Psychological Record, 70*(4), 543–558.

Grill, M., Pousette, A., Nielsen, K., Grytnes, R., & Törner, M. (2017). Safety leadership at construction sites: The importance of rule-oriented and participative leadership. *Scandinavian Journal of Work, Environment and Health, 43*(4), 375–384.

Grill, M. (2018). *Safety leadership in the construction industry: Managing safety at Swedish and Danish construction sites*. University of Gothenburg, Sahlgrenska Academy. Doctoral Thesis.

Grill, M., & Nielsen, K. (2019). Promoting and impeding safety: A qualitative study into direct and indirect safety leadership practices of constructions site managers. *Safety Science, 114*, 148–159.

Grill, M., Nielsen, K., Grytnes, R., Pousette, A., & Törner, M. (2019). The leadership practices of construction site managers and their influence on occupational safety: An observational study of transformational and passive/avoidant leadership. *Construction Management and Economics, 37*(5), 278–293.

Grill, M., Pousette, A., & Björnsdotter, A. (2023). Managerial behavioral training for functional leadership: A randomized controlled trial. *Journal of Organizational Behavior Management.*. https://doi.org/10.1080/01608061.2023.2171174.

Guo, B. H., Goh, Y. M., & Wong, K. L. X. (2018). A system dynamics view of a behavior-based safety program in the construction industry. *Safety Science, 104*, 202–215.

Güntner, A. V., Klonek, F. E., Lehmann-Willenbrock, N., & Kauffeld, S. (2020). Follower behavior renders leader behavior endogenous: The simultaneity problem, estimation challenges, and solutions. *The Leadership Quarterly, 31*(6) 101441.

Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*(2), 147–185.

Hoffmeister, K., Gibbons, A. M., Johnson, S. K., Cigularov, K. P., Chen, P. Y., & Rosecrance, J. C. (2014). The differential effects of transformational leadership facets on employee safety. *Safety Science, 62*, 68–78.

Jeschke, K. C., Kines, P., Rasmussen, L., Andersen, L. P. S., Dyreborg, J., Ajslev, J., Kabel, A., Jensen, E., & Andersen, L. L. (2017). Process evaluation of a Toolbox-training program for construction foremen in Denmark. *Safety Science*, *94*, 152-160.

Johnson. (2013). A component analysis of the impact of evaluative and objective feedback on performance. *Journal of Organizational Behavior Management*, *33*(2), 89-103.

Jonsdottir, I. J., & Kristinsson, K. (2020). Supervisors' active-empathetic listening as an important antecedent of work engagement. *International Journal of Environmental Research and Public Health, 17*(21), 7976.

Judge, T. A., & Piccolo, R. F. (2004). Transformational and transactional leadership: A meta-analytic test of their relative validity. *Journal of Applied Psychology, 89*(5), 755.

Kalata, A. H., & Naugle, A. E. (2008). Positive psychology: A behavioral conceptualization and application to contemporary behavior therapy. In O'Donohue & J. E. Fisher (Eds.), *Cognitive behavior therapy: Applying empirically supported techniques in your practice*. Wiley.

Kazantzis, N., Whittington, C., & Dattilio, F. (2010). Meta-analysis of homework effects in cognitive and behavioral therapy: A replication and extension. *Clinical Psychology: Science and Practice, 17*(2), 144–156.

Komaki, J. L. (1986). Toward effective supervision: An operant analysis and comparison of managers at work. *Journal of Applied Psychology, 71*(2), 270.

Komaki, J. L. (2015). *Leadership from an operant perspective*. Routledge.

Krause, T., Seymour, K., & Sloat, K. (1999). Long-term evaluation of a behavior-based method for improving safety performance: A meta-analysis of 73 interrupted time-series replications. *Safety Science, 32*(1), 1–18.

Kröger, C., Bode, K., Wunsch, E.-M., Kliem, S., Grocholewski, A., & Finger, F. (2015). Work-related treatment for major depressive disorder and incapacity to work:

Preliminary findings of a controlled, matched study. *Journal of Occupational Health Psychology, 20*(2), 248.
Kuehnl, A., Seubert, C., Rehfuess, E., von Elm, E., Nowak, D., & Glaser, J. (2019). Human resource management training of supervisors for improving health and well-being of employees. *Cochrane Database of Systematic Reviews*, *9*, No.: CD010905.
Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behaviour change: A systematic review of behaviour theories. *Health Psychology Review, 10*(3), 277–296.
Lacerenza, C. N., Reyes, D. L., Marlow, S. L., Joseph, D. L., & Salas, E. (2017). Leadership training design, delivery, and implementation: A meta-analysis. *Journal of Applied Psychology, 102*(12), 1686.
Latham, G. P., & Seijts, G. H. (2016). Distinguished scholar invited essay: Similarities and differences among performance, behavioral, and learning goals. *Journal of Leadership & Organizational Studies, 23*(3), 225–233.
Lee, J., Lim, S., & Oah, S. (2020). Effects of accurate and inaccurate feedback on work performance: The role of the awareness of inaccuracy. *Journal of Organizational Behavior Management, 40*(1–2), 46–62.
Li, H., Lu, M., Hsu, S.-C., Gray, M., & Huang, T. (2015). Proactive behavior-based safety management for construction safety improvement. *Safety Science, 75*, 107–117.
Lopes, R. T., Gonçalves, M. M., Fassnacht, D. B., Machado, P. P., & Sousa, I. (2014). Long-term effects of psychotherapy on moderate depression: A comparative study of narrative therapy and cognitive-behavioral therapy. *Journal of Affective Disorders, 167*, 64–73.
Love, T. S., Roy, K. R., Gill, M., & Harrell, M. (2022). Examining the influence that safety training format has on educators' perceptions of safer practices in makerspaces and integrated STEM labs. *Journal of Safety Research, 82*, 112–123.
Ludwig, T. D., & Geller, E. S. (1997). Assigned versus participative goal setting and response generalization: Managing injury control among professional pizza deliverers. *Journal of Applied Psychology, 82*(2), 253.
Martin, R., Hughes, D. J., Epitropaki, O., & Thomas, G. (2020). In pursuit of causality in leadership training research: A review and pragmatic recommendations. *The Leadership Quarterly* 101375.
Meslec, N., Curseu, P. L., Fodor, O. C., & Kenda, R. (2020). Effects of charismatic leadership and rewards on individual performance. *The Leadership Quarterly* 101423.
Newnam, S., & Goode, N. (2019). Communication in the workplace: Defining the conversations of supervisors. *Journal of Safety Research, 70*, 19–23.
Nykänen, M., Sund, R., & Vuori, J. (2018). Enhancing safety competencies of young adults: A randomized field trial (RCT). *Journal of Safety Research, 67*, 45–56.
Oswald, D., Lingard, H., & Zhang, R. P. (2022). How transactional and transformational safety leadership behaviours are demonstrated within the construction industry. *Construction Management and Economics, 40*(5), 374–390.
Palmer, M. G., Johnson, C. M., & Johnson, D. A. (2015). Objective performance feedback: Is numerical accuracy necessary? *Journal of Organizational Behavior Management, 35*(3–4), 206–239.
Park, J.-A., Johnson, D. A., Moon, K., & Lee, J. (2019). The interaction effects of frequency and specificity of feedback on work performance. *Journal of Organizational Behavior Management, 39*(3–4), 164–178.
Podsakoff, P. M., Bommer, W. H., Podsakoff, N. P., & MacKenzie, S. B. (2006). Relationships between leader reward and punishment behavior and subordinate attitudes, perceptions, and behaviors: A meta-analytic review of existing and new research. *Organizational Behavior and Human Decision Processes, 99*(2), 113–142.
Podsakoff, P. M., & Podsakoff, N. P. (2019). Experimental designs in management and leadership research: Strengths, limitations, and recommendations for improving publishability. *The Leadership Quarterly, 30*(1), 11–33.
Rapp-Ricciardi, M., Ulfdotter Samuelsson, A., Matton, E., Norderfeldt, E., Räisänen, C., & Grill, M. (2023). *Individualiserad träning i beteendebaserat säkerhetsledarskap [Individualized behavior-based safety-leadership training]*. 978-91-527-5810-6. Gothenburg University.
Robinson, P. (2008). Putting it on the street: Homework in cognitive behavioral therapy. In W. T. O'Donohue & J. E. Fisher (Eds.), *Cognitive behavior therapy: Applying empirically supported techniques in your practice*. Wiley.
Salas, E., Tannenbaum, S. I., Kraiger, K., & Smith-Jentsch, K. A. (2012). The science of training and development in organizations: What matters in practice. *Psychological Science in the Public Interest, 13*(2), 74–101.
SCB. (2022). *The Swedish Occupational Register with statistics.* https://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__AM__AM0208__AM0208E/YREG51N/table/tableViewLayout1/.
Schwatka, N. V., Goldenhar, L. M., & Johnson, S. K. (2020). Change in frontline supervisors' safety leadership practices after participating in a leadership training program: Does company size matter? *Journal of Safety Research, 74*, 199–205.
Schwatka, N. V., Goldenhar, L. M., Johnson, S. K., Beldon, M. A., Tessler, J., Dennerlein, J. T., ... Trieu, H. (2019). A training intervention to improve frontline construction leaders' safety leadership practices and overall jobsite safety climate. *Journal of Safety Research, 70*, 253–262.
Segrin, C. (2008). Social skills training. In W. T. O'Donohue & J. E. Fisher (Eds.), *Cognitive behavior therapy: Applying empirically supported techniques in your practice*. Wiley.
Shapiro, M., & Kazemi, E. (2017). A review of training strategies to teach individuals implementation of behavioral interventions. *Journal of Organizational Behavior Management, 37*(1), 32–62.
Sleiman, A. A., Sigurjonsdottir, S., Elnes, A., Gage, N. A., & Gravina, N. E. (2020). A quantitative review of performance feedback in organizational settings (1998–2018). *Journal of Organizational Behavior Management, 40*(3–4), 303–332.
Spigener, J., Lyon, G., & McSween, T. (2022). Behavior-based safety 2022: Today's evidence. *Journal of Organizational Behavior Management*, 1–24.
Steelman, L. A., Levy, P. E., & Snell, A. F. (2004). The feedback environment scale: Construct definition, measurement, and validation. *Educational and Psychological Measurement, 64*(1), 165–184.
Sundel, M., & Sundel, S. S. (2017). *Behavior change in the human services: Behavioral and cognitive principles and applications*. Sage Publications.
Tafvelin, S., Hasson, H., Nielsen, K., & von Thiele Schwarz, U. (2021). Integrating a transfer perspective into evaluations of leadership training. *Leadership & Organization Development Journal, 42*(6), 856–868.
Takala, J., Hämäläinen, P., Nenonen, N., Takahashi, K., Chimed-Ochir, O., & Rantanen, J. (2017). Comparative analysis of the burden of injury and illness at work in selected countries and regions. *Central European Journal of Occupational and Environmental Medicine, 23*, 6–31.
Theorell, T., Nyberg, A., Leineweber, C., Hanson, L. L. M., Oxenstierna, G., & Westerlund, H. (2012). Non-listening and self centered leadership: Relationships to socioeconomic conditions and employee mental health. *PLoS One1, 7*(9), e44119.
Tuncel, S., Lotlikar, H., Salem, S., & Daraiseh, N. (2006). Effectiveness of behaviour based safety interventions to reduce accidents and injuries in workplaces: Critical appraisal and meta-analysis. *Theoretical Issues in Ergonomics Science, 7*(3), 191–209.
Turner, J. S., & Leach, D. J. (2012). Behavioural activation therapy: Philosophy, concepts, and techniques. *Behaviour Change, 29*(2), 77–96.
Van Knippenberg, D., & Sitkin, S. B. (2013). A critical assessment of charismatic—Transformational leadership research: Back to the drawing board? *The Academy of Management Annals, 7*(1), 1–60.
von Brachel, R., Hirschfeld, G., Berner, A., Willutzki, U., Teismann, T., Cwik, J. C., ... Margraf, J. (2019). Long-term effectiveness of cognitive behavioral therapy in routine outpatient care: A 5-to 20-year follow-up study. *Psychotherapy and Psychosomatics, 88*(4), 225–235.
von Thiele Schwarz, U., Hasson, H., & Tafvelin, S. (2016). Leadership training as an occupational health intervention: Improved safety and sustained productivity. *Safety Science, 81*, 35–45.
Wang, B., Wu, C., Shi, B., & Huang, L. (2017). Evidence-based safety (EBS) management: A new approach to teaching the practice of safety management (SM). *Journal of Safety Research, 63*, 21–28.
Weatherly, N. L., & Malott, R. W. (2008). An analysis of organizational behavior management research in terms of the three-contingency model of performance management. *Journal of Organizational Behavior Management, 28*(4), 260–285.
Wirth, O., & Sigurdsson, S. O. (2008). When workplace safety depends on behavior change: Topics for behavioral safety research. *Journal of Safety Research, 39*(6), 589–598.
Yukl, G., Seifert, C. F., & Chavez, C. (2008). Validation of the extended influence behavior questionnaire. *The Leadership Quarterly, 19*(5), 609–621.
Zohar, D. (2002). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior, 23*, 75–92.

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