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ABSTRACT

Daily dialogue between leaders and workers on traditional construction sites is primarily focused on production, quality and time issues, and rarely involves occupational safety and health (OSH) issues. A leadership training program entitled 'Toolbox-training' was developed to improve construction foremen's knowledge and communication skills in daily planning of work tasks and their related OSH risks on construction sites. The program builds on the popular 'toolbox meeting' concept, however there is very little research evaluating these types of meetings.

This article describes the development, implementation and feasibility of the Toolbox-training program, and the results of the process evaluation and outcome evaluation. A total of 57 foremen from 12 companies participated in the training in five successive groups during 2014–2015. Following each group, the program was continuously evaluated and revised until the final version after the fifth group. The evaluation utilized an action research strategy with a mixed–methods approach of triangulating questionnaire, interview, and observation data.

Process evaluation results showed that the eight Toolbox-training topics were relevant and useful for the majority of the foremen, who experienced positive changes in their daily work methods and interactions with their crews, colleagues, leaders, customers and other construction professions. The program is a unique contribution to leadership training in the construction industry, and can potentially be applied and adapted in many other sectors. However, there is still a need for testing the long-term effects of the program on safety climate, injuries and business in future studies.

1. Introduction

Accidents at work, physical attrition of worker's health and early retirement are problems that persist in the Danish construction industry (Arbejdstilsynet, 2015). Construction workers are a vulnerable group with more than twice as high a risk for work-related accidents compared with the average rate for all Danish industries (Arbejdstilsynet, 2015). Work is often performed at multiple job sites and the mix of contractors, trades, and workers changes as projects progress, which provides many challenges in implementing initiatives to promote safety and safety culture in general (Lehtola et al., 2008).

Lingard et al. (2012) found that construction site supervisors are more likely to have a significant impact upon safety, compared to top managers and safety managers. The quality and frequency of safety communication between foremen and their work crews are associated with organizational safety practices and safety climate (i.e. employees shared perceptions of safety priorities) (Zohar and Luria, 2003; Zohar, 2010). Safety climate has been shown to predict employee safety compliance, participation and injuries (Clarke, 2006; Gillen et al., 2002). Additionally, foremen are often an active part of the work crew carrying out working tasks, and thus are the last link in the chain of formal decision-makers about the working environment and site safety.

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Construction project *Start-up* meetings and/or *risk evaluations* are often carried out prior to engaging in projects and tasks, which include a focus on improving occupational safety and health (OSH). A traditional way of communication are toolbox meetings (toolbox talks, tailgate meetings, etc.), which are a popular tool used in construction (and other industries) in many countries (Esmaeili and Hallowell, 2012; Hinze, 2003). These brief meetings typically involve a foreman's preparation and delivery of a specific OSH topic with his/her crew (e.g. safe use of machines, PPE, etc.) before work or during breaks. However, foremen and workers often end up having to make many crucial OSH decisions on a daily basis, and the daily OSH communication between a foreman and his work crew, colleagues, leaders, customers and other construction professions mainly addresses production issues and deadlines (Dyreborg et al., 2008; Kaskutas et al., 2013).

Although toolbox meetings are a valued form of safety communication in construction, research evaluating current practices is relatively rare. In their review of the literature, Olsen et al. (2016) found seven studies/papers related to the perceived importance, effectiveness and quality of toolbox meetings in construction and five articles related to the need for materials. Only one experimental field study evaluated a toolbox meeting intervention (Harrington et al., 2009). In the study, Harrington et al. (2009) developed and evaluated a program to train construction supervisors in giving more effective toolbox meetings.

Research on current practices suggests that there are opportunities for improving the frequency and quality of safety meetings (e.g. toolbox talks, toolbox meetings). However, some safety meetings are management-driven with little engagement of workers (Mäki and Koskenvesa, 2012). Thus, there is a need for further research on effective safety communication interventions in the construction industry.

The current project was designed to develop and evaluate a 'Toolbox-training' program in Denmark with focus on improving construction foremen's competencies to enhance effective planning and site safety practices, and to improve daily safety communication (Finneran et al., 2012). The Toolbox-training program goes beyond actual toolbox meetings, and focuses on foremen's planning, safety communication and safety work site behavior throughout the working day, not only at fixed meeting times, but also in daily ad hoc meetings and discussions. The program is focused on increasing workers' active participation and improving two-way communication. Forck (2005) and Williamsen (2003) identified methods, recommended by safety professionals, to engage workers or subcontractors, which include asking open-ended questions and making action plans with follow-up, which were included in the current training program (described below) (Forck, 2005; Williamsen, 2003).

1.1. The Toolbox-training program

The Danish Toolbox-training program aims to improve construction foremen's knowledge and skills in planning and safety communication, not only with their crew members, but also with their colleagues, leaders, other professions and customers. In the future, the goal of the training program would be to reduce physical attrition of workers' health and improve injury and accident prevention, health and safety culture.

More specifically, it is assumed that the program will promote safety communication on a daily basis between foremen and the various parties on site, which will improve cooperation between site members and increase their individual participation in OSH dialogue. Participation is proposed to then increase the foremen's and site member's influence on planning and safety procedures, which improves the promotion of OSH and safety culture on construction sites and subsequently results in improved business.

Fig. 1 provides a model showing the study's underlying program theory, which is the relationship between the Toolbox-training implementation and the Toolbox-training outcomes. The model includes process evaluation components to assess training implementation, activities and activity outputs, and the short-term and intermediate outcomes that are precursors to the expected long-term outcomes (Edberg, 2007). The large arrow indicates the expected pathways through the training program. The second row shows variables for each component of the model, with bidirectional vertical arrows to indicate an iterative process of feedback and adjustment (Campbell et al., 2000).

The purpose of this paper is to describe the design and development of the training program, the process evaluation as well as an outcome evaluation based on a theory-driven evaluation as outlined in the program theory. An action research strategy was taken, applying mixed methods in the evaluation. This is in contrast to a stringent effect evaluation and a method-driven evaluation which tend to minimize or ignore stakeholders' views and concerns in the evaluation.

2. Materials and methods

2.1. Study population

The study is based on 57 construction industry foremen (with 2–25 work crew members each) who participated in the training in five successive groups during 2014 and 2015. Following each group, the program was continuously evaluated and revised until the final version after the fifth group. The foremen represented twelve different construction companies covering two geographic regions in Denmark (Jutland and Zealand), and who worked in various construction trades (e.g. earth and concrete, masonry, carpentry, scaffolding, demolition). The research group approached fourteen companies' OSH directors, who forwarded the information to construction site managers and their foremen. An information and recruitment flyer was distribution and an article in a trade specific newspaper to attract participants. Recruitment of companies was also done in collaboration with the project's advisory panel consisting of representatives from employer and employee political organizations, OSH consultants and construction companies (e.g. with the companies informing their subcontractors). Due to this small, conveniently sampled study population, simple descriptive statistics within Excel were used to describe the data, as advanced statistical analyses would not have been appropriate or meaningful.

2.2. Toolbox-training program

A 22½ hour classroom program was developed by the project team and was carried out over five half-days (4½ hour per day), with two weeks of on-site training between training days, for a total program length of nine weeks. Training was provided by external training consultants (familiar with providing training courses in construction), and consisted of a mixture of theoretical lectures, practical casework and role-play, exchange of knowledge and experience between the participating foremen, as well as assignments to be carried out during the two weeks between each classroom session. The external consultants used a manual for the Toolbox-training program (*train the trainer*), which the project group developed together with the other training materials. Training focused on the central role of the foreman and the importance of dialogue, involvement and influence of employees (and other parties) to improve the daily OSH communication and planning of pre job and future tasks, and the managing of work related OSH risks. Foremen were to use the new skills and knowledge in

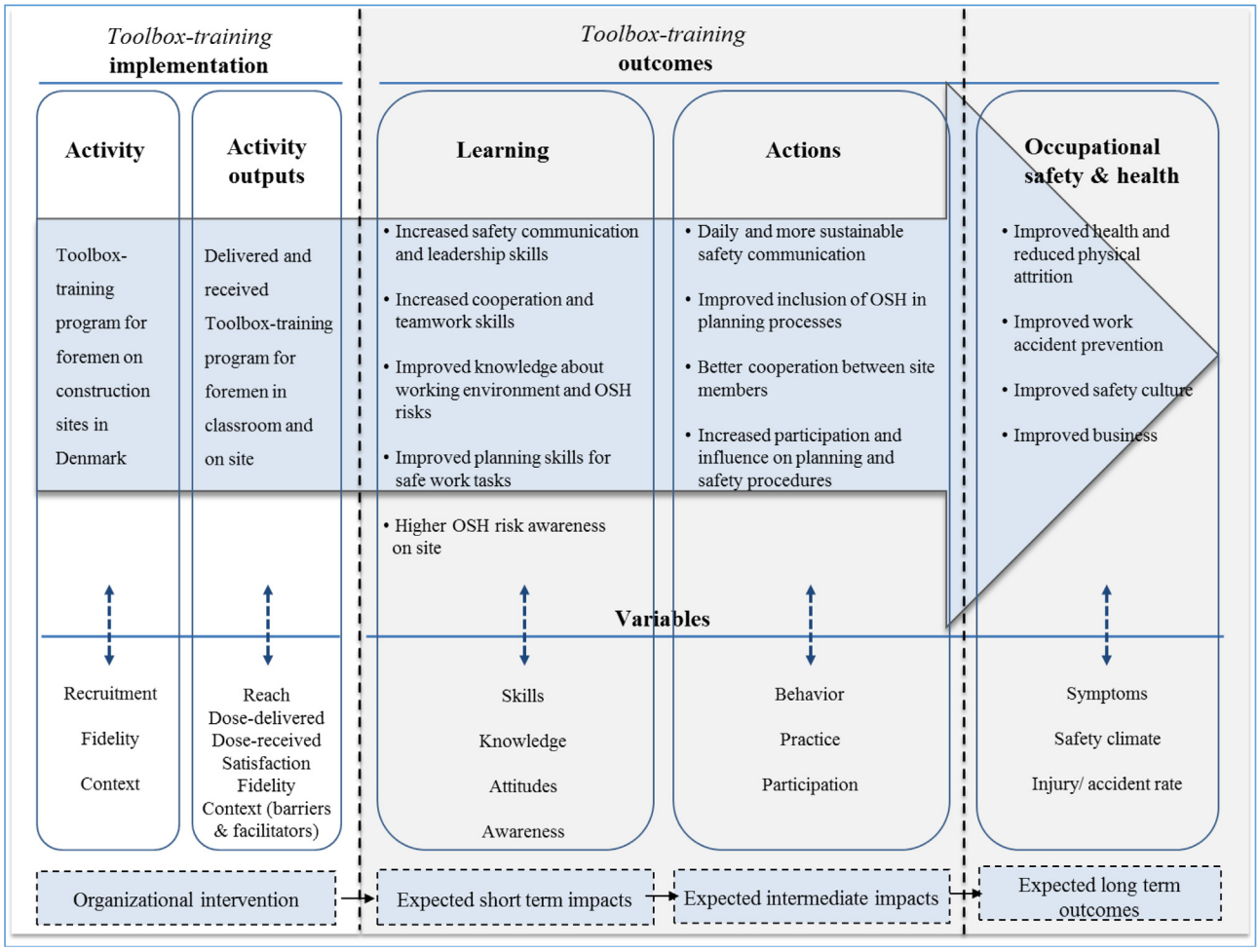

Fig. 1. Toolbox-training program: Core elements and expected pathways to improve occupational safety and health.

their daily activities with their work crew(s). Two project researchers (authors 1 and 2) followed the training program and visited selected participants throughout the program period to facilitate the implementation.

The training included the following eight topics with their corresponding eight tools:

- Foreman roles and responsibilities.
- Communication (questioning techniques and feedback).
- Body language (nonverbal).
- Cross-cultural communication.
- Conflict management.
- Leadership and cooperation.
- Planning systems (an adapted lean construction model).
- Prevention of injury and work related disease, as well as improving OSH on construction sites.

Hardison et al. (2014) confirmed that knowledge of pre job planning, organizing work flow, and establishing effective communication are highly important competencies for the construction foreman to possess. Gambetese and Pestana (2014) showed that the application of lean construction principles naturally led to enhanced worker safety (Gambetese and Pestana, 2014). Hinze (1981) found that leaders who expressed respect for workers and included their suggestions also had safer work crews. Shohet and Laufer (1991) showed that enhanced planning by the construction foreman led to improved productivity and safety at the job site. Based on this the Danish Toolbox-training program focused on improving construction foremen's knowledge of planning and organizing pre-job and coming work tasks and their related OSH risks on site to enhance work flow and site safety.

Another key element in the training was improving communication skills (verbal, non-verbal, cross-cultural) to establish effective safety communication between workers and foremen, as well as between foremen and their colleagues and top managers. Kines et al. (2010) recommended that foremen need to be trained in their safety communication with workers, but also in communicating to their superiors. Safety communication was proposed to have positive effects on safety performance within the organization (Burke et al., 2011).

The training also focused on enhancing leadership and cooperation skills, as positive relationships improve job performance, job satisfaction and safety performance (Michael et al., 2006). Involving employees (colleagues, leaders, customers and other construction professions) in the daily planning process and incorporating workers suggestions were fundamental elements in the training program.

Alongside with the above mentioned competencies Hardison et al. (2014) identified the importance for foremen to be competent in directing workers tasks and responsibilities, in order to increase the safety performance of the work force and to demonstrate the value of safety, thus reflecting the foreman's true commitment. Therefore, the Toolbox-training was designed to improve foremen's awareness as safety role models and their active participa-

tion in safety planning. Peterson (1999) found that when leaders visibly participate in safety policies workers saw safety as a principal organizational priority.

Another focus area in the training was to improve conflict management competencies. Conchie et al. (2011) and Odiorne (1991) recommended that a foreman should possess the knowledge and skills to identify escalating conflicts and how to resolve them. Brockman (2012) found that interpersonal conflict had a substantial negative effect on construction projects and its financial costs. Training in conflict management was thus proposed to reduce the incidence of interpersonal conflicts on the construction sites.

Finally, Toolbox-training was designed to improve foremen's knowledge to prevent occupational injuries and work related disease, as well as to improve OSH on construction sites. This included knowledge of identifying and managing health hazards, as well as strategies to control and prevent these hazards (Arbejdstilsynet, 2014).

2.3. Design of the process evaluation

The study included a detailed process evaluation of the training program which serves both a formative and a summative purpose. The formative evaluation strengthened the training program and helped form it by examining the delivery of the program, the assessment of the organizational context, personnel, procedures and inputs. The formative purpose involved a continuous use of process data and feedback from the participating foremen for optimizing training through learning, and determines if the training needed modifications.

The aim of the summative purpose was to determine whether the training was implemented as intended, to provide guidance for future interventions, and to evaluate the impact of the Toolbox- training on short-term and intermediate outcomes.

The process evaluation followed the framework introduced by Saunders et al. (2005), which is based on work by Steckler and Linnan (2002) and Baranowski and Stables (2000). According to the above-mentioned framework the following components are recommended to be included in process evaluations, and are used here to measure intervention activities and activity outputs: *recruitment*, *reach*, *dose-delivered* (completeness), *dose-received* (exposure), *fidelity* (quality), *satisfaction*, and *context* (barriers and facilitators). The process evaluation components used in this study are defined as follows:

Recruitment was defined as the sources and procedures used to approach and attract foremen for participation in the Toolbox-training. All foremen were informed about the main objective and content of the research project and participated voluntarily. The program was free, and foremen received permission from their companies to participate during their working hours.

Reach was defined as the proportion of foremen who were approached for participation in the Toolbox-training. In the present study the intended audience was construction foremen in Denmark with staff management responsibilities (e.g. to lead a work crew), and a certain level of financial as well as operational responsibility.

Dose-delivered was the proportion of the pre-planned Toolbox-training days which was actually provided by the training consultants to the participating foremen. In this study five *classroom training* days were planned to be provided to each of the five training groups.

Dose-received was the proportion of participants showing up for the training days.

Fidelity was the extent to which the intervention was implemented as planned. In this study participants were to implement the training tools themselves during the two-week *on-site training* between each of the five *classroom training* days. Additionally, two project researchers followed the implementation process throughout the training period to facilitate implementation. We measured to which extent foremen were engaged with, and used materials or tools from the training using self-report survey items (e.g. usefulness of training tools), and interviews with selected foremen.

Satisfaction was defined as the foremen's opinions and attitudes towards the Toolbox-training. We used interview data to describe the participants' experiences.

Context was defined as factors (e.g. aspects of the larger social and political environment) which either hindered or facilitated the implementation of Toolbox-training. We used field notes and interview data to describe the context surrounding the training and participating construction sites.

Finally, we evaluated the impact of the Toolbox-training on the following short-term and intermediate outcomes.

Short-term impacts included learning constructs of skills, knowledge, awareness and attitudes towards the training activities and activity outputs. Skills were measured by the foremen's ability to communicate and engage with his work crew in safety dialogue, to plan work tasks safely and to lead by example (e.g. find solutions, motivate crew members to work safely). Knowledge (e.g. knowing when and how to use training tools, identifying safety risks), awareness (e.g. ability to point out why work tasks are physically demanding or unsafe) and attitudes (e.g. willingness to try new tools) were measured using survey items, interviews and field notes.

Intermediate impacts were assessed by foremen's behaviors, practice and participation of work crew members & others. Data sources included surveys in which foremen were asked to report their individual use of Toolbox-training tools, observations and interviews with selected foremen and work crew members.

We summarized all evaluation elements into five main research questions for the process evaluation:

(1) Was the expected target population reached? (reach, recruitment). (2) Was the program implemented as intended? (fidelity, dose-delivered, dose-received). (3) How did the foremen and their work crews experience the training? (satisfaction). (4) How was the implementation influenced by contextual factors? (context). (5) What impact did the training have on foremen's learning (short-term outcomes) and actions (intermediate outcomes)?

By documenting all of these aspects of the implementation process we were to asses to what extent the implementation was successful. In the case of a successful implementation, we examined if our program theory (Fig. 1) could be confirmed, that is, if the organizational intervention of the training program led to the expected short-term and intermediate outcomes.

2.4. Data collection procedure

To carry out this process evaluation we used three data sources (triangulation) with a mixed-method approach: repeated self-report surveys for all participating foremen before and after the training, semi-structured interviews with selected foremen and their work crew members (and where relevant - leaders and colleagues) before, during and after the training. Due to this being a developmental project, the semi-structured interviews allowed for the addition of new topics/issues. Additionally, we listened to and observed the foremen during the training days and at their construction sites (Waddington, 1994). The information from these data sources were used to assess the implementation according to the above-mentioned framework, and enabled the identification of confirmatory or conflicting issues. The data triangulation also enabled the identification of patterns in all the collected data, in

order to develop an overall interpretation, including multiple views on the implementation process. In the following, the main data sources for the process evaluation are explained more in-depth.

2.4.1. Questionnaires for participating foremen

We distributed a short online questionnaire to participating foremen from group 2 to 5 before (n = 48) and after (n = 43 foremen, who participated at least four out of five times) the training. The questionnaires were distributed at baseline (T0), directly at the end of the fifth training day (T1) and after respectively 2–10 months (T2) after the training (group 2: after 10 months, group 3: after 7 months, group 4 and 5: after 2 months). We assessed to what degree foremen gained new knowledge, new skills, higher risk awareness, to what degree the different training tools were experienced as useful on site, to what degree foremen experienced positive changes in organizing work tasks and participation of work crew members, etc.

2.4.2. Individual interviews with participating foremen

Individual semi-structured interviews (n = 20) with selected foremen were conducted before, during (n = 23) and after the training program (n = 15 telephone interviews). The interviews were transcribed and thematically coded based on the research questions and the process evaluation components. We assessed to what degree and why different training tools and skills were utilized, barriers and facilitators for the implementation of the Toolbox-training (context), to what degree the foremen were satisfied with the training program, and if the training was implemented (fidelity and dose delivered). We asked how often foremen talked to their crew members, which topics they discussed and to which extent the foremen experienced a change in the communication, participation and OSH behavior of their work crews.

2.4.3. Individual interviews with selected work crew members

Individual semi-structured interviews (n = 36) with selected work crew members were conducted before and after the training program. Additionally, the training consultants answered questions about the content structure of the training program, and usability of methods and materials in order to optimize the program.

2.4.4. Development process

Important data was gained through an interactive and iterative development process of the training program. The formative purpose of the process evaluation involved a continuous use of feedback from the participating foremen. We involved all participants and used their feedback to develop and optimize the content and framework of the training program. Thus, the program was successively adjusted between the five different groups.

We (authors 1, 2 & 4) observed foremen's participation, engagement, behavior and attitude towards the training in the classroom, and visited a representative sample of them at their construction sites to see if and how they applied the knowledge and skills from the eight topics and tools. We assessed the degree of safety communication, which materials (e.g. leaflets, copies) were distributed to the work crews, whether communication type (e.g. dialogue) and content had changed (e.g. safety and health topics), whether foremen used training tools on site, and we linked foremen's behavior during the five training days to this utilization (*dose-delivered* to work crew members).

3. Results

We used the program theory (Fig. 1) to demonstrate the use of process evaluation to optimize the training program. In order to illustrate the application of the program theory to the intervention results, we provide examples of process evaluation outcomes and answers to each of the five research questions.

3.1. Was the expected target population reached?

Recruitment: Twelve out of fourteen companies sent foremen to participate in the Toolbox-training program. Thus, *reach* was 85.7%. However, we were unable to successfully recruit foremen from micro and small companies with less than 100 employees.

3.2. Was the program implemented as intended?

Dose-delivered was 100%; that is, four different training consultants delivered all five training days to each of the five training groups (one trainer delivered 2 of the programs). A total of 57 foremen participated in the training program, but only foremen who participated in at least four out of the five training days, were included in the process evaluation. *Dose-received* was 86% for all five groups (i.e. 49 out of 57 foremen).

High *fidelity* was given if participants: gained more knowledge/skills, were actively engaged with the training, and/or used the training tools/materials on site. The results provided evidence that the training topics were relevant and useful for the foremen in their everyday interactions with their crews, colleagues, leaders, customers and other construction professions. Directly at the end of the fifth training day foremen were asked to what degree each of the topics/tools were relevant for their daily work on site (Fig. 2). Over 80% of the foremen found that all eight training topics/tools were to a "high" or "very high" degree relevant for their work, particularly the tools regarding 'Conflict management', 'Communication' (both verbal and nonverbal), 'Planning systems' and 'Foremen roles and responsibilities'. These were followed by fairly similar results for the latter three topics/tools regarding 'Cross-cultural communication', 'Prevention of injuries & work related disease' and 'Leadership and cooperation'. One formative output was to modify the training if needed, e.g. "How to hold a toolbox meeting" was one of the topics with the first group, but was removed as the participants did not feel a need for having more structured meetings with their work crews, but rather to be more effective in their current formal and informal (ad-hoc) daily communication with both their crews, colleagues and leaders.

Results showed that more than 50% of the 36 foremen, surveyed 2–10 months post-intervention, still used various training tools to a "high" or "very high" degree. Particularly the questioning techniques and feedback (verbal communication tools), as well as 'Body language' and 'Foremen roles and responsibilities' were among the most used tools (Fig. 3). Due to nonresponse and employee turnover only 36 of the 43 foremen (43 foremen from group 2 to 5) answered the follow-up surveys.

Inclusion of OSH in their daily planning and communication was seen as giving added value to their work and their projects. The results showed that the degree of knowledge regarding planning, health, attrition and safety communication increased, and that participant's attention to their role as foremen, safety engagement, risk awareness, and assignments of leadership responsibilities increased from before to after the training.

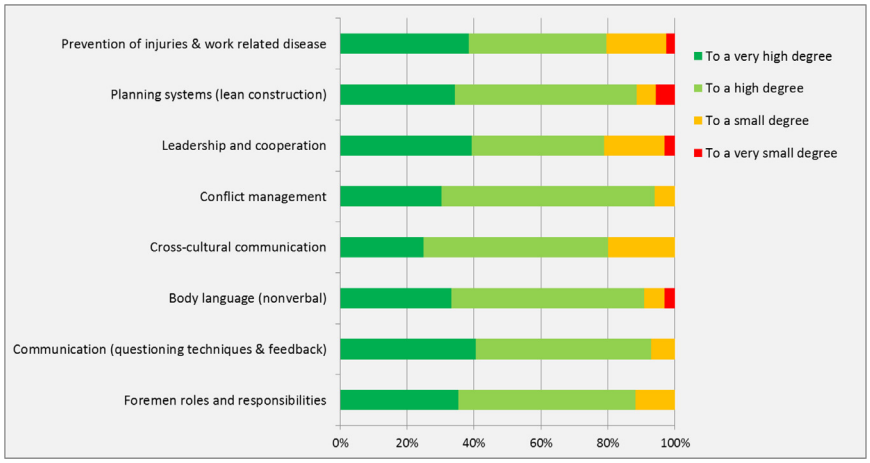

Fig. 2. Relevance of Toolbox-training topics/tools directly at the end of the fifth training day ($n = 43$ foremen from groups 2 to 5).

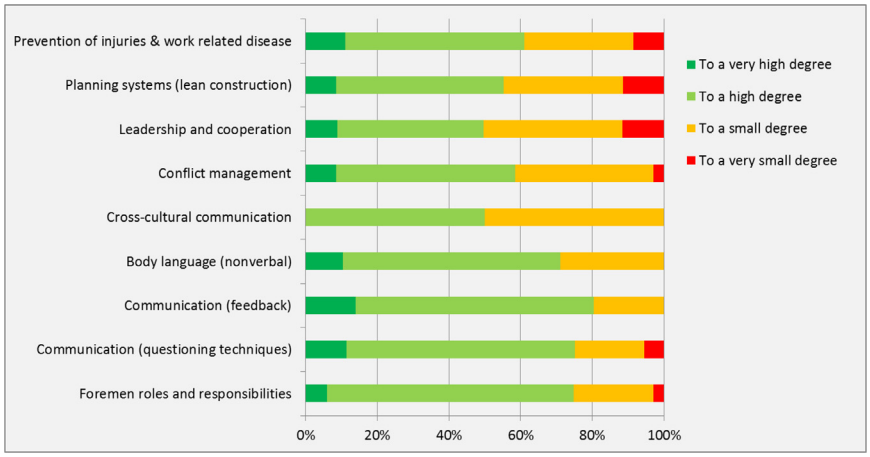

Fig. 3. Usefulness of Toolbox-training topics/tools 2–10 months post-intervention ($n = 36$ foremen from groups 2 to 5).

3.3. How did the foremen and their work crews experience the training?

Foremen reported back that they gained knowledge and skills to engage with work crew members in daily safety dialogue, and the augmented communications skills were used to improve work task planning (*satisfaction*).

One foreman responded during the training as follows: "*I will calculate our overall noise level on site. I think there is much focus on work accidents, but after what we have talked about today, I want to focus more on occupational diseases.*"

Moreover, the foremen utilized the given training materials in their daily work, e.g. training templates were posted in the on-site workers' hut, or were used for joint reviews of work tasks together with the work crew. The foremen used their improved communication skills just as much with their own leaders, colleagues and clients, as they did with their own work crew(s). One foreman reported back as follows:

> "*After Toolbox-training I have become much more conscious about using open-ended questions, and to ensure participation. Especially with conflict management – escalation and resolution [one of the training tools] has been good. It has been particularly useful, since I had to use it for negotiations with management about piecework contracts. But I also use it in everyday situations. For example, we have challenges with our foreign subcontractor, who is responsible for demolition, and in other cases we have issues with residents - in both cases I made sure I involved construction site management in solving the problem.*"

Foremen reported that they had a better understanding of their role as foremen, they felt more responsible for communicating and mediating safety information between management and crew members, and they understood their position as role models to implement changes. They were also highly motivated to facilitate change, e.g. one foreman delivered an action plan on how to motivate and involve his work crew more frequently by giving his work crew more responsibility in making decisions. His crew members formed an internal working group to plan social activities, and they chose a *contact-person* in addition to the crew boss to reduce the work load on the foreman's shoulders.

In the beginning, foremen experienced that involving crew members in dialogue and asking open-ended questions was awkward and a threat to the 'power relations', but recognized a positive change in their work crews' reactions and that it reduced their own work load. After completing an assignment on site one foreman reported the following:

> *"Instead of delegating the work, I asked who would take care of it. There was a pause and that was somewhat awkward. I said this is up to you today. There was a person who volunteered... that it would be ok. One may take too much responsibility. If you can't do that* [let employees take initiative and responsibility] *you will hang on the phone all day* [making decisions for them], *it's great when they* [work crew] *can* [take responsibility]. *It must also be good to take responsibility.*"

The selected work crew members that were interviewed reported back that they felt involved in decisions when the fore-

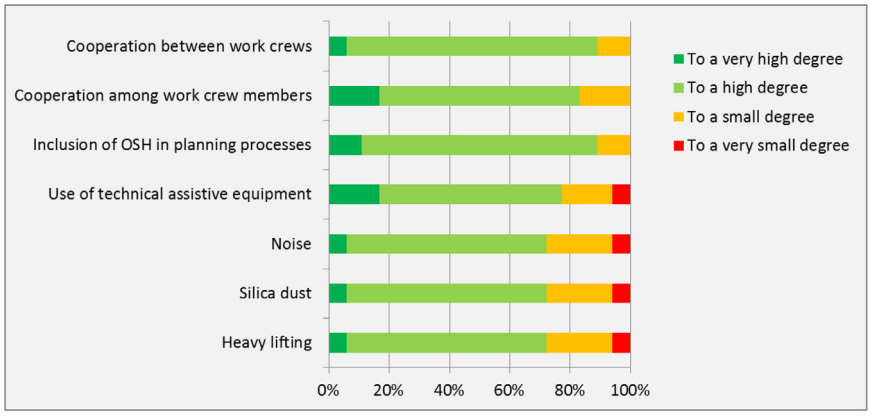

Fig. 4. Toolbox-training: Positive changes in work methods 2–10 months post-intervention (n = 36 foremen from groups 2 to 5).

man asked them open-ended questions without giving answers beforehand, and when using the planning system tool together with other members of the work crew.

3.4. How was the implementation influenced by contextual factors?

The context includes factors that did not result from the training program, but which may have influenced delivery and can be seen as another formative output. The participants' individual attitude and opinion towards the training and need for change were, in some cases, contextual barriers, which hindered the implementation of the effects of Toolbox-training**.** Not all participants used the training tools after completion of the program, and not all foremen liked to ask work crew members for their input and opinions. One foreman used the planning system tool, but did not involve his work crew in the planning process. He did not feel that employee involvement was necessary based on his understanding of a foreman as an 'in-control organizer', who does not ask questions but provides instructions. Another barrier was the high turnover among work crew members, e.g. one foreman reported back that he borrowed manpower from other foremen:

> "*It's easier to use that* [Toolbox-training tools] *with people who are your own. It's a waste of time to use a personality type tool* [leadership and cooperation training tool] *or questioning techniques with them, as they disappear again.*"

Work crew members reported that other hindering factors which affected OSH dialogue and knowledge sharing negatively were the lack of interest among their colleagues, tight time schedules, busy foremen talking on the phone and not being able to get their foreman's attention. Communication barriers with foreign subcontractors were also experienced as a challenge, and we optimized the Toolbox-training program addressing these cultural and language challenges by adding a new training topic: cross-cultural communication for groups 4 and 5, which can be seen as another formative output.

3.5. What impact did the training have on foremen's learning and actions?

3.5.1. Short-term impact: learning

Analysis of repeated surveys, interviews and field notes showed that foremen were more aware of their role as a leader (e.g. to lead by example), and as to why crew members needed individually targeted OSH communication (e.g. motivate crew members to work safely). Foremen felt knowledgeable about communication and planning work tasks safely (e.g. knowing how and when to use training tools, identifying safety risks), they had a positive attitude towards applying new training tools (e.g. willingness to try new tools), and were aware of OSH risks in their work tasks (e.g. ability to point out why work tasks are physically demanding or unsafe).

3.5.2. Intermediate impact: actions

Three-quarters of the 36 foremen experienced positive changes in their work methods and organizing work tasks (e.g. inclusion of OSH in planning processes, improved cooperation among work crew members and between work groups from different construction trades) (Fig. 4). The inclusion of OSH in planning processes and cooperation between work groups scored highest with more than 80% of all foremen recognizing positive changes in work methods to a "very high" or "high degree". Improved cooperation included e.g. better communication between work groups due to questioning techniques which led to an understanding of other work groups' behavior. More than 70% of the foremen also changed their work methods regarding the use of technical equipment, and they reported that they encouraged their work crews to use the appropriate equipment.

Process evaluation results showed that 90% of the 36 foremen talked "Always" or "Often" about "Planning" and "Production" with their work crews. However, over 40% talked "Always" about the "Use of protective equipment" and 38% talked about "Safety" every time they met with their work crew. Kines et al. (2010) found that construction site workers perceived safety as part of their verbal communication with their foremen in only 6–16% of their daily exchanges. Our results indicated that some foremen's communication type (e.g. dialogue) and content had changed (e.g. safety and health topics) over time. Other foremen reported no behavioral changes, and referred to the various barriers to implementing the training tools as described above under "context".

4. Discussion

This study provides evidence that the concept of toolbox-meetings can be expanded to a 'Toolbox-training' program and is adaptable to the construction safety culture in Denmark to successfully improve OSH dialogue among foremen and other parties on construction sites. A program theory (Fig. 1) was applied to the design of the training program, and was found useful in describing the training program plan and in providing feedback on its delivery.

The program was well-received among foremen, and there were some indicators of improvements in planning and safety communication among the foremen and their crew members. Similar studies have found that toolbox meetings improved knowledge and behavior among employees (Hinze, 2003; Dedobbeleer and

German, 1987; Kaskutas et al., 2013). Toolbox meetings, with focus on fall prevention, suggested that safety communication training had an effect not only on participating foremen, but also on young apprentices' safety practices and at the worksites that the foremen directed (Kaskutas et al., 2013). Kines et al. (2010) showed that construction site safety improved when foremen increased verbal safety dialogue. Workers have an informal and oral culture of risk, in which safety is rarely openly expressed. Increased communication skills (verbal, non-verbal, cross-cultural) to establish effective safety communication between workers and foremen, as well as between foremen and their colleagues and top managers, are central to improve safety.

Foremen play a central role when it comes to engaging work crew members actively in dialogue and problem-solving discussion on site. They can help to optimize safety in an otherwise dynamic industry, where people and processes change constantly. Given that feedback from leaders and recognition are amongst the most powerful incentives influencing job performance (Stajkovic and Luthans, 2003), construction foremen should be trained how to teach their crew members and provide feedback to affect their safety behaviors (Kaskutas et al., 2013). Our study elaborates on these previous findings by showing that the concept of toolbox meetings can be successfully expanded to a Toolbox-training program.

Early findings from short-term outcomes indicated the foremen benefited from the current Toolbox-training program; detailed analysis of the long-term data will need to be evaluated in the future. In the training program, foremen learned from the training, improved their safety communication (e.g. asked workers for ideas, motivated worker participation in OSH dialogue), and attempted to take actions to involve their work crews in the planning process to reduce their risk of injury and attrition of workers health.

Impact on learning and actions are early indicators of efficacy based on the training program, and as mediators to the long-term outcomes enabled a description of why the training program did or did not improve OSH (Edberg, 2007). It was important to use the process evaluation to determine how Toolbox-training worked under normal, everyday working conditions, as contextual factors affected the degree of implementation (Cole et al., 2009; Hengel et al., 2011). This demonstrates the value of describing the training program plan, using a process evaluation to determine what was actually delivered, and interpreting both short and long-term data based on the delivered training program. The study showed that the training program is feasible. However, only half of the responding foremen used the training tools after 2–10 months post-intervention. To increase the number of foremen using the tools in their daily practice on site, even several months after the training, the embeddedness of positive changes in organizations has to be strengthened (e.g. through management support). In a future study we will investigate which organizational conditions support the long-term embeddedness of the Toolbox-training program, and data collection on long-term outcomes (injuries, site safety, safety climate, etc.) will need to be carried out.

A strength of this study is that we were able to address several construction trades and that we developed a manual for the Toolbox-training program *(train the trainer),* and therefore it can easily be delivered in various construction groups, and adapted to other industries. In the present study we purposefully used different trainers with recent construction experience. Trainers with experience and relations within the construction industry increased the relevance of the Toolbox-training.

There were however, some challenges with the study. We often trained very experienced foremen, who had been on several training courses, and who already had a high degree of OSH knowledge. The foremen were from twelve different construction companies, most of which were noted for having ambitious OSH programs. Thus, the foremen's responses may not be representative of construction foremen in general. For the purpose of optimizing the program, the selected target group was well chosen and gave valuable feedback, which allowed for continuous improvement of the program. All foremen reported a high degree of knowledge transfer within the group of participants, due to their different occupational backgrounds (e.g. different construction companies and various construction trades). A limitation of this study is that we were not able to recruit small and medium sized enterprises. Although the principles of the Toolbox-training program may also apply to smaller companies, finding the resources to participate in such programs may be challenging.

5. Conclusions

This study investigated the feasibility of the Toolbox-training program and to what extent the implementation was successful. The training program reached the expected target population (e.g. foremen), was delivered 100% (e.g. all five training days were delivered to each of the five training groups), and 86% of the foremen from all five groups attended the program. Therefore the program was implemented as intended.

The study identified training needs and opportunities for construction foremen and their work crews. Toolbox-training was well-received among foremen, and their degree of OSH knowledge, planning and safety communication skills increased. Safety communication between foremen and their work crews improved, as interviewed work crew members' participation in OSH dialogue increased, which made them feel more involved in decisions regarding work tasks. The study suggests that work crews' participation in safety communication and active employee involvement has a positive impact on planning and OSH procedures. The majority of the foremen were actively engaged with the training, and used the training tools as well as materials on site 2 to 10 months post-intervention. As a result, the organizational intervention of the training program led to the expected short-term and intermediate outcomes, which is why we confirm our program theory (Fig. 1).

However, foremen did not utilize all eight training tools and skills after the training program, and a change in a foreman's OSH communication and behavior is not always evident for work crew members. The most common factors, which hindered the foremen in applying their new knowledge and skills, were tight production schedules, turnover and lack of interest among work crew members, and individual attitudes towards the training.

Determining the efficacy of the Toolbox-training program involves more than evaluating long-term outcomes. In preparing for the diffusion of interventions in dynamically changing work environments, researchers must describe and measure their program implementation.

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