Safety Science 94 (2017) 152–160

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

Process evaluation of a Toolbox-training program for construction foremen in Denmark

Katharina Christiane Jeschke [a,*], Pete Kines [a], Liselotte Rasmussen [b], Lars Peter Sønderbo Andersen [c], Johnny Dyreborg [a], Jeppe Ajslev [a], Anders Kabel [d], Ester Jensen [e], Lars Louis Andersen [a,f]

[a] National Research Centre for the Working Environment, Lersoe Parkalle 105, Copenhagen DK-2100, Denmark
[b] NIRAS, Sortemosevej 19, Alleroed DK-3450, Denmark
[c] Danish Ramazzini Centre, Department of Occupational Medicine, Regional Hospital West Jutland, Gl. Landevej 61, Herning DK-7400, Denmark
[d] Team Working Life, Høffdingsvej 22, Valby DK-2500, Denmark
[e] Metroselskabet/ Hovedstadens Letbane, Metrovej 5, Copenhagen DK-2300, Denmark
[f] Physical Activity and Human Performance Group, SMI, Department of Health Science and Technology, Aalborg University, DK-9220 Aalborg, Denmark

ARTICLE INFO

Article history:
Received 1 July 2016
Received in revised form 16 January 2017
Accepted 20 January 2017
Available online 30 January 2017

Keywords:
Toolbox meetings
Toolbox talks
Leadership training
Safety training
Safety communication
Lean construction

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.

* Corresponding author.
E-mail address: kcj@nrcwe.dk (K.C. Jeschke).

http://dx.doi.org/10.1016/j.ssci.2017.01.010
0925-7535/

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