



Is more engaging safety training always better in reducing accidents? Evidence of self-selection from Chilean panel data



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ABSTRACT

Introduction: The recent events in Chile involving 33 miners who were trapped and rescued in the *San José* mine led the government to strongly promote occupational safety and health (OSH) training. However, there is an ongoing debate regarding which type of training is the most effective in reducing accidents. **Method:** The “engagement hypothesis” claims that traditional classrooms are rather ineffective and that only a strong student involvement may generate meaningful results, but the empirical evidence is inconclusive. To contribute to this debate, we claim that the selection of the training method may be contingent on the firm’s OSH capabilities and commitment. Firms with fewer (greater) capabilities may optimally self-select less (more) engaging training methods. **Results:** Accordingly, based on panel data from 2003 to 2009 for a representative sample of 2,787 Chilean firms, the engagement hypothesis initially appears to be supported; however, after correcting for self-selection bias, it loses most of its significance. **Impact on industry:** Chilean policymakers are strongly advised to expand OSH training.

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1. Introduction

The recent events in Chile involving 33 miners who were trapped and successfully rescued in the *San José* mine launched a major assessment of the Chilean occupational safety and health (OSH) system by a committee of experts (Chilean Government, 2010). Among other recommendations, the committee strongly suggested the promotion of safety training to encourage prevention. Almost immediately the Chilean authorities declared the objective of doubling the prevention investments in the short term, prioritizing training. Should Chile pursue such an ambitious goal? And perhaps more importantly, which type of training investment should Chile prioritize? In this article we attempt to answer these questions and in doing so, contribute to an ongoing controversy in the OSH literature.

The scientific literature suggests that training is not the solution for all aspects of OSH. Although training has been proven effective in improving OSH awareness and behavior, as reported in the surveys by Cohen and Colligan (1998) and Robson et al. (2010), there is no consensus in terms of objective outcomes, such as workplace accidents. Burke, Scheuer and Meredith (2007), Burke et al. (2011) argue that studies about OSH training do not always show objective outcomes because they do not make a proper distinction among different types of training. The authors claim that only the training efforts that generate a high learner engagement (i.e., more involved trainees) are actually effective

in improving OSH. The authors “challenge the current emphasis on passive training methods” (p. 315) suggesting that this may be the cause for lack of consensus in the impact of OSH training. Their view can be summarized as the “engagement hypothesis,” which states that training with higher level of trainee engagement is strictly better in terms of improving OSH performance.

In spite of the intuitive appeal of this hypothesis, the evidence is again inconclusive. Robson et al. (2010) question the empirical evidence presented in Burke et al. (2006, 2011) that supports the engagement hypothesis. The questioning is based on the potential bias resulting from self-selection. In a firm-level analysis, this bias is caused by unobserved firm characteristics. Firms with strong OSH capabilities (e.g., committed senior executives, better OSH climate) are likely to have fewer accidents and simultaneously tend to select more sophisticated and high engagement training methods. If this contention is correct, then an estimation that does not correct for firm unobservable characteristics may cause a correlation between engaging methods and fewer accidents to be misinterpreted as causality.

Based on stage learning theory (Anderson, 1985), we propose a “contingency hypothesis”: the type of training that best suits a company is contingent on its level of OSH experience and commitment and therefore there isn’t a single method that outperforms the others. In particular, firms that are initiating their OSH prevention activities might be better off with simpler and straightforward methods whereas firms that have a long commitment to OSH might gain more by using more sophisticated and engaging training methods.

To test the contingency hypothesis, we use panel data from 2003 to 2009 for a representative sample of 2,787 Chilean firms (i.e., using

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random and stratified selection). Our estimation technique corrects for self-selection using a fixed effect panel data model.

This article is divided into seven sections. Following this introduction, the second section reviews the empirical evidence on the impact of OSH training on accidents, without distinguishing between training methods. The third section – the core of the paper – presents the “engagement hypothesis,” its empirical support and introduces the competing “contingency hypothesis” based on self-selection and stage learning arguments. The fourth section introduces the details of the Chilean OSH training strategy and proposes specific predictions for the different training methods observed in Chile. The fifth section describes the database and the econometric methodology. The sixth section presents and discusses the results. And the seventh section concludes with a recommendation for Chilean OSH policy.

2. Evidence on the impact of OSH training

OSH training suffers from market failures (Pouliakas & Theodosiou, 2013) that force governments to evaluate its effectiveness,¹ and eventually promote it if it is socially beneficial (Radon et al., 2010). In the United States, Cohen and Colligan (1998) performed a comprehensive review of the literature on OSH training funded by the NIOSH (National Institute for Occupational Safety and Health, the US agency for OSH). The 80 peer-reviewed studies from 1980 to 1996 that were analyzed “were near unanimous in showing how training can attain objectives such as increased hazard awareness among workers, knowledge of and adoption of safe work practices and other actions that improve workplace safety” (p. 5). However, Cohen and Colligan (1998) note the lack of studies relating training to objective OSH outcomes (e.g., accidents or illnesses) instead of behavior or knowledge acquisition, the lack of longitudinal studies, and the prevalence of case studies and site-specific analyses.

The follow-up study of Robson et al. (2010) incorporated the studies that were conducted between 1996 and 2005. Following a stringent selection of 22 papers based on methodological rigor out of approximately 160 studies, the authors reached similar conclusions: behavior and knowledge acquisition is affected by training; however, there is no clear evidence that accidents and diseases decrease after training. The authors report a small effect that they regard as “insufficient evidence of the effectiveness of training on outcomes” (p. 82). Moreover, these authors criticize the methodology that is used in the existing literature and advocate for “more rigorous studies that assess the impact of specific training factors on outcomes” (pp. 77–78).

The meta-analysis performed by Burke et al. (2006) included 95 studies that were conducted between 1970 and 2003 in 15 countries and revealed evidence of the effectiveness of knowledge and behavior, but more importantly, they found that outcomes were significantly improved by training efforts. Moreover, these authors expanded the study in Burke et al. (2011) by covering 113 studies, confirming their previous results and therefore contradicting Robson et al. (2010). Unfortunately, Burke et al. (2006, 2011) do not correct for the self-selection problem that Robson et al. (2010) carefully address when selecting studies for the meta-analysis.

In summary, the empirical literature regarding the influence of training on OSH outcomes is inconclusive. The few studies that correct for self-selection bias and that report a small effect (Robson et al., 2010) are narrow in industrial scope and thus are limited in their ability to provide meaningful generalizations. Conversely, large meta-analyses (Burke et al., 2006, 2011) show that training has a significant effect on safety outcomes, but these studies could be contested on methodological grounds.

¹ For example, three notable studies evaluating prevention activities have been funded by OSH government agencies. O’Grady (2000) was funded by the Canadian agency, Liu et al. (2010) by the Pennsylvania State Agency, and Cohen and Colligan (1998) and Robson et al. (2010) by the NIOSH.

3. The “engagement hypothesis” and training effectiveness

3.1. Theoretical arguments

According to Burke et al. (2006), the lack of conclusive evidence on the impact of OSH training on accidents is a consequence of the emphasis of current OSH training on a rationalistic approach to learning, which assumes that adults can receive, process, remember, and then apply without error the “external and general” information. This may produce a lecture-like classroom structure with large but unengaged audiences (Burke et al., 2007). Burke et al. advocate the use of engaging training methods. Their view can be summarized as the “engagement hypothesis”: compared to other training methods, engaging methods are *always* superior in improving OSH performance. In engaging training, such as feedback-based training with specific content, and behavioral modeling and hands-on based training (Burke et al., 2006), learners are active participants in their learning experience (Bell & Kozlowski, 2008). Whereas rationalistic approaches to instruction have “emphasized the importance of tightly structuring the learning environment, so as to limit trainees’ control, and of providing step-by-step instruction on the complete task and its concepts, rules, and strategies ... [engaging methods] not only give people control over their own learning but use formal training design elements to shape the cognitive, motivational, and emotional learning processes that support self-regulated learning” (Bell & Kozlowski, 2008: p. 296).

The mode (or the structure) and the content of training can be shaped to increase trainee engagement (Salas & Cannon-Bowers, 2001). Different approaches to learning generate different training practices, both in content and structure. In contrast to the rationalistic approach, other approaches – such as the action regulation theory (Hacker, 2003) or behavioral learning theories (Cox, Jones, & Rycraft, 2004; Geller, 2001) – that position the mental models and behavior of learners in the forefront of analysis, may produce more engaged training activities where the trainees incrementally develop their own mental models of appropriate behavior based on external positive reinforcement or ex-post behavior reflection. Also, the role of a trainer is not simply to provide information but to guide the development of the analytical framework and behavior of trainees.

Engaging training is advocated by Burke et al. for three main reasons: first, extensive trainer and trainee dialog and involvement are required to deliver the complex and specific knowledge that embeds OSH training (Burke et al., 2007); second, because OSH performance is determined by the behavior of workers, training efforts should emphasize behavioral change through experience; and third, engaging training provides adaptive tools to ensure that workers can cope and react to the inherent uncertainties that cause and antecede workplace accidents (Burke et al., 2011). In contrast, when using non-engaging training it is difficult to transmit complex knowledge, to change behavior, and to provide other tools to the worker than simple recipes for action.

The theorization of Burke yields a prediction of the dominance of engaging training. As the theory assumes that good behavior, complex knowledge, and adaptiveness are the pre-requisites of good OSH performance *in every situation and context*, a corollary of Burke’s analysis is that *engaging methods of training will always be more effective than non-engaging training approaches*.

3.2. Empirical evidence for the engagement hypothesis

The meta-analyses by Burke et al. (2006, 2011) reveal evidence that supports the hypothesis that engaging training is more effective than classic training. These authors classify 95 studies according to the degree of engagement in the training methods of each study and find that more engaging training leads to greater improvements in OSH performance. Their conclusion extends to three levels: knowledge acquisition, behavior, and outcomes (accidents and diseases). Cohen and Colligan (1998) provide more specific supportive evidence: training

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