Construction safety personnel’s perceptions of safety training practices

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Abstract

The effectiveness of safety training practices is an important part of safety management on a construction site. Safety professionals’ perceptions of the effectiveness of training practices in safety training sessions were sought in a survey administered to the top 400 contractors in the U.S. The study shows that contractors are sensitive to organizational, feedback, content, process, and worker issues. Whenever they encounter language problems, they use visual aids, and provide translators and safety guidelines written in workers’ own language. Very few statistically significant differences are observed when the findings are analyzed from the point of view of the demographic characteristics of the respondents. The contribution of this study is that it conveys the views of safety personnel about how safety learning can be achieved, sustained and improved by addressing organizational, feedback, content, process, and worker issues in training sessions. It provides project managers with best practices in safety training sessions.

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Keywords: Safety performance; Safety training; Learning; Training language

1. Introduction

Construction is considered to be a risky endeavor because of the high frequency of work-related fatalities and serious injuries. According to the Bureau of Labor Statistics (BLS) (2013a), the number of fatal work injuries in the U.S. was reported as 4628 in 2012, and 806 of these were recorded in the construction industry, while the total number of non-fatal cases was 905,690 in the same year with 71,730 of those recorded in the construction industry. Given the high proportion of fatal and non-fatal accidents occurring in the construction industry, construction companies constantly seek different and novel strategies to reduce the number of work-related accidents.

The construction safety literature shows that researchers mostly focus on safety performance on construction sites and on ways to minimize the number and severity of accidents. For example, Huang and Hinze (2003) investigated construction worker falls and found that falls represent a high proportion of construction accidents that result in fatalities. Esmaeil et al. (2012) developed a framework to investigate the effectiveness of fall protection systems in roofing projects. In another study conducted by Janicak (2008), the number of fatalities caused by electrocutions was found to be higher for workers in the age group 16–19, and that 125 fatalities could be prevented through effective lockout–tagout programs and verification of energy isolation. As evidenced by these few examples and many others, in general, the literature highlights the importance of the development of effective strategies in preventing work accidents in the construction industry. One such strategy that is mentioned often in the literature is formal, well organized and effective safety training. Effective safety training may lower accident rates, but there are several challenges...
associated with safety training that need to be overcome by construction companies. The extent to which workers’ learning experiences are affected in safety training sessions and the extent to which workers learn safe practices in training sessions is among these challenges. Furthermore, the language barrier experienced by non-English speaking workers is a common factor that interferes with learning in safety training. However, the perceptions of safety personnel about training practices, and about the problems caused by the language barrier in safety training sessions are rarely investigated.

The objective of this study is to explore safety training practices based on the perceptions of safety personnel. This paper reports the practices of safety personnel employed by a sample of the top 400 contractors in the U.S. relative to achieving, reinforcing and improving “safety practices” in safety training sessions. Project managers who adopt effective safety training practices should be able to improve safety performance at construction sites. Additionally, the study also guides safety managers in developing sound safety plans and in better executing those plans.

2. Safety training and “learning”

Several techniques have been proposed to minimize the frequency and severity of accidents. For example, a study sponsored by the Construction Industry Institute (2002) identified nine areas, among which orientation and specialized training occupy a prominent position. Hinze et al. (2013) conducted interviews with the representatives of 57 projects in the U.S. and found that higher performance is achieved with intense safety training. Hallowell (2012) conducted eleven case studies in different regions of the U.S. and found that the most common methods used by companies to transfer safety knowledge are orientation and training sessions, toolbox talks, informal safety communication among workers, and formal presentations by safety managers. Overall, the current literature supports the view that training is a major factor in sustaining and improving safety performance. Learning is an important dimension of training and is discussed in the following two subsections.

2.1. Learning by native English speakers

Some examples of research work that involves “learning” in safety training include the following. Han et al. (2008) state that low skill levels, inadequate technical knowledge, and a steep learning curve are the factors that affect the safety performance of construction workers in a negative manner. Porteous (1997) states that safety knowledge, skills and abilities could be improved by well-generated learning theories. The Occupational Safety and Health Administration specifically requires that safety proficiency be evaluated and documented by the use of a written assessment and a skill demonstration to evaluate the knowledge and individual skills developed in the course of training (OSHA, 2012). Kirkpatrick (1998) suggests that the effectiveness of learning could be tested by observing the differences between a control group that does not receive training and a trained group. Furnham (2005) argues that individuals learn best when they encounter an obstacle or an intellectual challenge that is of interest to them. According to Furnham (2005), the best way to help people learn is to explain the abstract of the situation and provide varied examples over an effective learning period. Furnham (2005) also states that people learn by modeling others’ skills. In addition, Furnham’s (2005) study also indicates that safety learning might be achieved by computer-aided tools since it has the benefit of being self-paced.

BLR (2007) reports that three basic learning styles exist, including visual learning, auditory learning, and hands-on learning. Workers learn things in different ways and at their own pace. For example, visual learners learn best by seeing, while auditory learners like to listen, and hands-on learners learn best through practical instruction. The BLR (2007) report suggests using more visual aids in safety training sessions. Dudley (2010) defines two teaching styles commonly used by trainers, namely andragogical and pedagogical styles. In the andragogical style, the learner is self-directed and is responsible for his/her own learning. Contrarily, in the pedagogical style, the trainer takes the full responsibility in how the material is learned and the trainer evaluates learning. In the andragogical style, learners are internally motivated, display self-esteem, recognition, and confidence, while in the pedagogical style, learners are externally motivated by competition for performance and the negative consequences of failure.

It is to be noted that safety training is negatively affected by factors such as economic downturns, limited training budgets, and unpredictable product and technical innovations (Furnham, 2005). Additionally, the efficiency of safety training programs depends on organizational, feedback, content, process, and worker-related issues.

Organizational issues consist of the firm’s structure, middle management’s commitment to safety, and the effectiveness of safety trainers in improving the quality of training sessions. Bontis et al. (2002), Sicilia and Lytras (2005), and Pham and Swierczek (2006) assert that a supportive firm structure results in knowledge transfer and motivates workers to learn quickly and capture the necessary information in an effective manner in safety training sessions. According to Jaselskis et al. (1996), and O’Toole (2002), middle management’s commitment to safety training results in experiencing lower injury rates and helps with improving a company’s safety culture. Concerning the qualifications of a trainer, OSHA standards mandate that a trainer is considered to be qualified if he/she has previously completed a training program on the subject to be instructed. Furthermore, these trainers are expected to possess relevant academic credentials and teaching experience (OSHA, 2013).

Feedback issues play an important role in improved safety performance. Indeed, according to Furnham (2005), safety performance is enhanced by accurate and timely feedback because feedback reinforces safety learning. Also, Loosemore (1998) conducted research about the psychological mechanisms that cause poor safety performance in construction companies and found that feedback should be continuous to achieve actual safety performance that is aligned with planned performance. Therefore, feedback issues deserve special attention in conducting safety training.
Issues related to the content of training sessions consist of goal setting before conducting safety training and developing the safety training content with respect to worker needs and interests. A well-designed content that addresses worker needs and interests results in higher efficiency during training sessions as workers start with different levels of knowledge (Tam and Fung, 2012). Therefore, designing safety training content requires an in-depth analysis of the materials, methods, and processes that are perceived by workers to be of importance to safety.

Issues related to the training process may have significant impact on the effectiveness of safety training. The use of visual aids in the training session deserves special attention. Miller et al. (2012) emphasize that the use of 4D and 5D visualization tools helps to increase the knowledge gained in training sessions. Also, observing worker practices after training sessions could indicate how much workers learned in the training session.

Worker-related issues include encouraging worker awareness about safety issues, promoting pride in work completed without accidents, and motivating workers through frequent and effective training meetings. Workers who are part of an effectively trained team take pride in their firm if projects are completed with a great safety record (Bontis et al., 2002). Han et al. (2008) studied critical factors and possible solutions to motivate foreign construction workers and found that one of the measures to be taken to motivate foreign construction workers was training for better communication. Wanberg et al. ‘s (2013) study revealed that the promotion of safety and quality can be achieved through strategies such as assigning resources to preplanning, motivating leadership at workplace, and motivating workers to take pride in their work. The literature appears to support the idea that a good safety record can be achieved if workers are motivated through effective training.

There are several methods that can be used to train workers in construction safety. Kraiger (2003) highlighted four methods, namely computer-based training which is flexible, cheap and allows easy-access; team training which aims to practice with other teammates’ tasks, roles and responsibilities in order to increase understanding; cross-cultural training which helps with enhancing sensitivity and flexibility towards cultural differences; and corporate training which consists of distance learning and specialized courses. McMahan et al. (2010) encourage the use virtual environments as a strategy in worker training because they found that virtual environment applications improve worker training in pre-inspections of haul trucks and operational procedures of conveyer systems. In another study, Chen et al. (2013) proposed a virtual system that consists of a BIM/2D model developed to enhance safety awareness by the careful consideration of hazard types and safety issues along with the testing of users’ ability to resolve problems, hence offering a “learning by doing” technique to better recognize site hazards and gain awareness about the severity of accidents.

2.2. Learning by non-English speakers

Many foreign-born workers are currently employed on construction sites. According to the Bureau of Labor Statistics (BLS) (2013b), there were 25 million foreign-born persons in the U.S. labor force in 2012, comprising 16.1% of the total workforce. Foreign-born workers in occupations related to construction, maintenance, installation, repair, and natural resource extraction constituted 11% of the total foreign-born workers in 2012. While some of these workers understand rudimentary English, others do not speak the language at all, creating a communication problem that may become a grave issue in safety training sessions. Dai and Goodrum (2011) state that the many Hispanic workers employed in the U.S. construction industry have problems in understanding their supervisors’ safety instructions because their primary language is Spanish. In addition, Hispanic construction workers experience a larger number of accidents presumably because of their lack of English language skills (Dai and Goodrum, 2011). Indeed, according to the findings of a survey conducted by the Center to Protect Workers’ Rights to investigate the effect of language barriers, many Spanish-speaking workers experience language problems and have trouble in understanding safe work procedures (Ruttenberg and Lazo, 2004). Even though training consisted of small-group activities conducted by Spanish-speaking peer trainers who used Spanish-language guides, handouts and power-point slides in the companies surveyed by the Center to Protect Workers’ Rights, one of the most frequent requests made by the trainees was for more videos, graphics, and statistics in Spanish.

Canales et al. (2009) investigated the training needs of American supervisors and Hispanic workers and found that the ability to communicate improved when American supervisors and Hispanic workers took courses in Spanish and English as a second language, respectively. Han et al. (2008) found that the low performance of foreign construction workers was caused by ineffective safety training programs and lack of evaluation in safety training sessions. Évia (2011) proposed the use of computer-based training materials in improving the training of Hispanic workers more than the localization of existing training products in English. Another study conducted by Lin et al. (2012) focused on developing 3D safety training materials on fall-related hazards for construction workers who have limited English proficiency or low literacy. The study revealed that 3D simulated virtual job sites are effective in enhancing learning in training sessions by construction workers who have limited English proficiency.

3. Research methodology

A questionnaire was developed to investigate safety personnel’s perceptions of training strategies in the top 400 contractors in the U.S. The recipients of the questionnaire survey were obtained from the top 400 contractors list of Engineering News-Record (The Top 400 Contractors, 2011). The e-mail list was developed by using information collected from websites such as http://www.jigsaw.com/ and http://cmaanet.org/search-a-cmpm. The questionnaire was administered through a service called SurveyMonkey (http://www.surveymonkey.com). Out of the 400 companies approached, 58 responses were received by the cut-off date of October 11th, 2011, amounting to a rate of response of 15%. The actual rate of
response must have been a little higher because some of the email addresses sent to prospective respondents were outdated or incorrect, hence somewhat reducing the sample size to less than 400.

The questionnaire was designed to seek the views of safety personnel employed by large construction companies through two questions. Question 1 was designed to get information about construction companies’ strategies relative to the achievement of “learning” in safety training. It asked “how do you achieve and reinforce ‘learning’ in worker safety training?” Question 2 sought to clarify the ways of handling language problems for non-English speakers while training them for safety. It asked “How do you solve language problems for non-English speakers while training them for safety?” The eighteen sub-questions in Question 1 and eight sub-questions in Question 2 can be seen in Figs. 2 and 3, respectively. These sub-questions were rated by the respondents on a scoring system of 0–4, where 0 = never, 1 = seldom, 2 = sometimes, 3 = often and 4 = always. The average score was calculated automatically by the ‘rating average’ tool of SurveyMonkey (http://www.surveymonkey.com).

The characteristics of the respondents were also sought to better analyze and interpret the results. The respondents of the survey were mostly safety coordinators or safety managers. According to the American Society of Safety Engineers (2013), these individuals play an important role in training sessions since they are actively involved in developing and implementing methods to control hazards on construction sites.

The responses were grouped by annual turnover, size of employment force, age of the company, union membership, type of construction undertaken (building vs. civil works), and by location. The average age of responding companies was found to be 63 years. This result is not surprising because several years of experience is a key factor in the growth of a construction company. It must indeed have taken several years for a company to be listed in ENR’s top 400 contractors list. The average annual revenue of the companies was found to be $1104 million. Again, it is expected for the top companies to have very high annual revenue since the ENR top 400 contractors list includes companies with the highest annual revenue. The average number of employees in the responding companies was found to be 5319. Table 1 summarizes the characteristics of respondent firms.

The respondent companies were also grouped as union and nonunion. The union status of a company was found to be important since union companies may have different safety training strategies than nonunion companies. According to American Rights at Work (2012), unions fight for workers’ health and safety and as a result, union members are more likely to be well-trained about workplace hazards and risks. Additionally, union workplaces are more supportive in encouraging OSHA (Occupational Safety and Health Administration) standards (Weil, 1991). The data indicated that 59% of the responding companies were union and 41% nonunion companies.

The type of construction undertaken was also considered to be an important variable in the investigation of companies’ safety training strategies. It was found that 61% of the responding companies are mostly involved in building construction, while the remaining 39% are pursuing mostly civil works. The final variable that was considered to be important is geographical location. The study investigated whether the location of the responding companies played a role in the ratings collected in the survey. Fig. 1 shows the location of the responding companies.

The information relative to age, number of employees, annual dollar volume, and type of construction undertaken was obtained directly from the respondents through queries in the questionnaire. The determination of union status and geographical location required Internet research about each and every responding company.

In this study, SPSS 19.0 was used to perform the Mann Whitney U test in order to see if the differences between the groups are statistically significant at α = 0.05. The Mann–Whitney U test was preferred to a parametric test such as an analysis of variance (ANOVA) because parametric tests assume that the observations in the samples follow a normal distribution. Since the sample of 58 observations considered in this study is split into smaller sub-samples (i.e., old vs. young companies, large employers vs. small employers, large revenue vs. small revenue, building vs. civil contractors, union vs. non-union companies, northern vs. southern states) for comparison purposes, it is safer to assume that the fewer observations in the smaller sub-samples are not normally distributed. The Mann–Whitney U test that was used in this study is a non-parametric test that is used when samples are not normally distributed.

4. Findings about learning in worker safety training

Learning performance plays an important role in the achievement of the objectives of safety training. Companies may use different methods to achieve or reinforce safety learning objectives. However, they all aim to teach workers about safe work practices and consequently to reduce the number, frequency, and severity of accidents.

Fig. 2 shows the choices that were available to the respondents and the rating averages of the responses to Question 1 “how do you achieve and reinforce learning in worker safety training?” on a scale of 0–4, where 0 represents never, and 4 always. Ten of the eighteen choices that received an average rating of 3 (often) and higher deserve special attention, but given the very slight differences in the ratings (except for the last three), one should not totally disregard the remaining choices. Therefore, all the choices are discussed and interpreted.

4.1. Organizational issues

According to respondents, employing qualified safety trainers is the most important issue in achieving “learning” in safety

<table>
<thead>
<tr>
<th>General contractors</th>
<th>Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of the firm (years)</td>
<td>63</td>
<td>58</td>
<td>13</td>
<td>141</td>
</tr>
<tr>
<td>Annual revenue (million dollars)</td>
<td>1104</td>
<td>175</td>
<td>0.5</td>
<td>22,329</td>
</tr>
<tr>
<td>Number of employees</td>
<td>5319</td>
<td>550</td>
<td>12</td>
<td>100,000</td>
</tr>
</tbody>
</table>
training with a rating of 3.5 out of 4.0 (See Fig. 2). Indeed, safety trainers who are qualified by OSHA standards (OSHA, 2013) are more aware of workers’ problems than unqualified safety trainers. Additionally, qualified safety trainers are able to adjust the content of the safety training to be consistent with workers’ needs. Trainers become “qualified” after completion of courses offered by OSHA, and are then allowed to conduct occupational safety and health training (OSHA, 2012). An organizational structure that is set up to pay special attention to safety training (average rating 3.41) and to allow middle management participation (average rating 3.34) is also considered by the respondents to be effective in encouraging good learning habits and in motivating workers. Indeed, research indicates that a supportive organizational structure encourages workers to capture the necessary information and learn quickly (Bontis et al., 2002; Pham and Swierczek, 2006; Sicilia and Lytras, 2005). Moreover, Hallowell’s (2012) eleven case studies support an organizational setup that encourages all sorts of formal and informal training sessions. Also, Jaselskis et al. (1996) and Choudhry et al. (2007) found that middle management’s commitment to safety is very effective in enhancing workers’ safety culture.

Figure 1. Location of the responding companies.

Figure 2. Average responses to “how do you achieve and reinforce learning in worker safety training?”
4.2. Feedback issues

The third issue cited by the respondents (average rating 3.40) involves providing accurate feedback and is aligned with Furnham’s (2005) work that states that accurate feedback improves learning skills, clarifies safety learning, and reinforces strong communication among workers, as well as Loosemore’s (1998) work which emphasizes that continuous feedback is necessary to achieve planned safety performance. Hence, it is not surprising that the companies in ENR’s top 400 contractors list have enough resources to provide a strong feedback stream that reinforces the communication with workers. While feedback can be obtained by tracking the worker and the frequency of accidents, it can also be obtained by recording worker behavior leading to accidents (average rating 3.12). Feedback can also be obtained by using reflection. For the learning to occur by reflection, the learners should recapture, re-evaluate and re-think their previous experiences and simulate the meaning of the things that they have previously experienced (Beaudin and Quick, 1995). Encouraging individual thinking, group discussions, exchanging ideas, comparing training notes, and organizing roundtable discussions might leverage learning by reflection. This study indirectly investigated reflection by looking into the extent to which experienced workers share their knowledge with inexperienced workers. See survey question “Experienced workers share their safety knowledge with inexperienced workers” in Fig. 2. Since the average score for this question was 2.84 (close to “often”), it can be stated that safety training in the responding companies is mostly performed in an environment where experience sharing does occur. In summary, formal and informal feedback are important in boosting workers’ learning relative to safety.

4.3. Content issues

Setting safety goals ahead of a training program is conducive to effective and quick learning by workers (average rating 3.31). Safety goals should address workers’ needs and interests (average rating 3.14). The selection of the appropriate teaching style within the range defined by Dudley’s (2010) andragogical and pedagogical styles motivates workers to learn. Also, an appropriate and consistent content prevents workers from being distracted in safety training sessions. Developing training content is one of the training needs defined by OSHA (OSHA, 2012). OSHA documents explain that appropriate content in safety training allows workers to be more aware of the potential hazards and risks of construction. For example, Furnham (2005) found that firms setting safety goals before training do not encounter many workers’ compensation claims. Workers’ involvement in the discussions and asking questions in safety training sessions makes safety training more effective (average rating 3.20) as workers’ needs become more apparent in impacting the goals.

4.4. Process issues

Visual aids can be permanent reminders unlike spoken instructions (BLR, 2007). Therefore, safety trainers often make use of visual aids during safety training sessions (average rating 3.16). However, it is important to test whether workers absorb the information delivered orally and visually. Hence, exams administered during or after safety training allow workers to take stock of what they have learned, and trainers to evaluate how much workers learned in training sessions. Therefore, exams are considered to be helpful tools in evaluating the level of learning in safety training (average rating 2.82).

4.5. Worker issues

Awareness about critical safety issues (average rating 3.05) encourages workers to respond to dangerous situations faster, which enhances a project’s safety performance (Bontis et al., 2002). Therefore, construction companies sometimes prefer to employ only safety-trained workers (average rating 2.14). Also, language problems impede communication and may require repeated training. Therefore, training non-English speakers might be a challenge for construction companies. To prevent these problems, some companies prefer to hire only English speakers (average rating 1.98).

The pride in work completed without accidents is a motivating factor for safety training (average rating 2.97). Indeed, Bontis et al.’s (2002) research also indicates that workers take pride in their firm as long as they work in a safe environment. Some construction companies provide safety training as often as daily (average rating 2.93) not only to reduce the frequency and the severity of accidents, but also to send the message that they care about worker safety, hence creating pride in the company. The BLR report (2007) reveals that daily training is a great refresher for the worker to learn the importance of personal protective equipment use, safety procedures, job assignments and responsibilities. Attendance in a safety program that meets as often as daily is important in motivating workers to obey safety rules (average rating 2.95) because attendance and involvement are essential in implementing the rules.

4.6. Analysis by control variables

This study investigated the effects of six control variables on the responses to Question 1.

- Age of the company — 31 young companies (i.e., companies that are less than 60 years old) vs. 27 old companies (i.e., companies that are more than 60 years old)
- Number of employees in the company — 31 large employers (i.e., companies employing more than 300 employees) vs. 27 small employers (i.e., companies employing fewer than 300 employees)
- Annual dollar volume of the company — 25 large companies (i.e., companies having more than $200 million annual revenue) vs. 33 small companies (i.e., companies having less than $200 million revenue)
- Union status (i.e., 34 union companies vs. 24 non-union companies)
- Type of work undertaken by the company — (i.e., 35 building vs. 23 civil work)
• Geographical location of the company — (i.e., 32 northern vs. 26 southern states)

The results of the Mann Whitney U test are presented in Table 2 and show that there is no statistical difference between the control variables cited above relative to the very large majority of the issues investigated in Question 1. There were only five statistically different answers at \( \alpha = 0.05 \) marked with an asterisk in Table 2. The findings indicate the following:

• Older companies are more experienced than younger companies in designing safety content that responds better to workers’ needs and interests; larger employers can afford their middle management to be more involved in safety training. This finding is supported by Lin and Mills’ (2001) study that states that larger firms’ commitment in safety is stronger than smaller firms, and that larger firms tend to be more effective in dealing with health and safety issues. Wilson and Koehn (2000) also emphasized that large employers have a better safety performance since they have more resources invested in safety training programs.

• Companies that perform mostly civil works design the content of training sessions more in line with worker needs and interests, because civil works include many diverse types of construction including highways, bridges, railroads, dams, sewage systems, tunnels, etc., each requiring a tailor made training program, whereas building construction — regardless of whether it is an office building, a hospital, a residential complex, etc. is more uniform. According to Rowlinson (2004), civil works do indeed have more variety of works leading to the use of heavy equipment of different kinds compared to building construction. The need for a variety of large plant and equipment brings the need for training more diverse personnel. Thus, it can be concluded that companies that mostly perform civil works hire different personnel for the many diverse tasks, hence their familiarity with diverse workers’ needs.

• Companies that mostly perform building works monitor workers’ safety-related behaviors more closely than companies that are involved mostly in civil works, because building works involve a large number of activities with a multitude of trades compared to civil works that are generally composed of fewer activities with fewer trades. Rowlinson (2004) mentions that building works are more labor intensive and more repetitive than civil works, hence providing the opportunity to observe safety-related behaviors of workers more consistently.

• Union companies are more sensitive than non-union companies to employing well qualified safety trainers because unions monitor their members’ wellbeing quite diligently, as evidenced by Dedobbeleer et al.’s (1990) research that found that union workers have higher safety performance scores than those who are non-union.

• Companies that are located in southern states reward workers who have completed safety training successfully more than companies located in northern states. According to Weil (1991), unionized workplaces (located mostly in northern states) enforce OSHA rules in a stricter manner than nonunion workplaces (located mostly in southern states). While worker safety training is closely monitored by labor unions in northern states, worker safety training depends a great deal not only on company policy and culture, but also on the diligence of workers in nonunion construction in southern states, hence the reward system of individual workers who successfully complete safety training in southern states.

5. Language problems for non-English speakers

The construction industry is a multi-cultural industry. Many contractors in the U.S. employ non-English speakers and experience language problems in safety training sessions. A survey conducted by the Center to Protect Workers’ Rights investigated the effect of the language barrier on safety for Spanish-speaking workers. The results showed that many Spanish-speaking workers experience language problems and that they have trouble in understanding safe work procedures (Ruttenberg and Lazo, 2004). The profile of construction workers changes according to geography, language, and culture. Non-English speakers have been an issue for some companies. Therefore, Question 2 of this survey was designed to investigate whether contractors in the U.S. experience language problems when training non-English speakers.

Fig. 3 shows the response choices and rating averages of the responses to Question 2 on the same 0–4 scale where 0 represents never, and 4 always. Given the very slight differences in the ratings, one should consider all the choices.

According to Fig. 3, the use of visual aids in safety training sessions is found to be very useful in solving language problems (average rating 3.00) as “a picture is worth a thousand words”. Sometimes translators help in training non-English speakers (average rating 2.58), workers are trained in their own language (average rating 2.55), and workers are provided with guidelines written in their own language (average rating 2.55). OSHA regulations suggest that workers should be trained in their own language in order to protect them against accidents (OSHA, 2012), and that safety materials should match workers’ literacy proficiency (Michaels, 2010). It is therefore not surprising that many contractors comply with OSHA rules and provide safety training and safety guidelines in the workers’ own language.

Sometimes construction companies in the U.S. prefer hiring only workers who speak English (average rating 1.95), because some non-English speakers may require more frequent training (average rating 1.80), and some non-English speakers are more likely to be in accidents (average rating 1.68). The companies that do employ non-English speakers seldom provide language courses to these workers (average rating 1.52) even though OSHA recommends that training be conducted in a language that workers understand (OSHA, 2012).

5.1. Analysis by control variables

Table 3 presents the average ratings of the choices picked by the respondents in Question 2, arranged by the six control variables. The differences that are statistically significant at
Organized safety trainers are employed 3.4 3.6 3.5 3.6 3.4 3.6 3.8
Survey items Young
organizational, feedback, content, process, and worker issues.
Large contractors in the U.S. are sensitive to
collected are analyzed and interpreted. The findings of the
studies; the survey methodology is described; and the data
practices is explained by making use of the findings of past
reported and discussed in this study. The importance of training
employed by a sample of the top 400 contractors in the U.S. are
“6. Conclusion
The methods used to achieve, reinforce and improve
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studies; the survey methodology is described; and the data
collected are analyzed and interpreted. The findings of the
survey show that large contractors in the U.S. are sensitive to
organizational, feedback, content, process, and worker issues.
• Organizational issues, i.e., employing qualified safety trainers,
setting up an organizational structure that supports safety
training, and encouraging middle management involvement in
safety training.
• Feedback issues, i.e., providing feedback to workers,
obseving workers’ safety-related behaviors, and allowing
experienced workers to transfer safety knowledge to less
experienced workers.
• Content issues, i.e., setting goals ahead of safety training,
and encouraging worker input at safety training sessions.
• Process issues, i.e., using visual aids in safety training, and
conducting periodic tests to assess worker learning.
• Worker issues, i.e., encouraging worker awareness about
safety issues, promoting pride in work completed without
accidents, and motivating workers through frequent (daily)
training meetings.
These findings show that the majority of the large contractors
in the U.S. consider effective safety training as a company
strategy for better safety outcomes.
The differences in workers’ native language constitute a
challenge in safety training. Some workers who are not native
English speakers are at risk for workplace injuries. Safety training
of non-English speakers plays an important role in reducing work
accidents. There is plenty of evidence in previous research that
points out to the vulnerability of workers with language problems

α = 0.05 are identified by using the Mann Whitney U test, and
are marked by an asterisk. No statistically significant differ-
ences are observed in the large majority of cases, indicating that
the language problem is perceived in the same way by old
and young companies, small and large employers, union and
non-union companies, and building and civil engineering
contractors. The only control variable that is of significance is
geographical location. Compared to companies located in
northern states, companies located in southern states prefer
hiring English-speakers (average rating 2.4). This finding may
be explained by the fact that southern states in the U.S. may
include more non-English speakers because they are closer to
the Mexican border.

6. Conclusion
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organizational, feedback, content, process, and worker issues.

Table 2
Average ratings for “how do you achieve and reinforce learning in worker safety training?” by control variables (0 = never, 4 = always).
Survey items
Young companies Old companies Large employer Small employer Large revenue Small revenue Union Non-union Building Civil states
<60 years >60 years >300 <300 >$200 million <$200 million

<table>
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<tr>
<th>Questions/answers are encouraged in</th>
<th>Young companies</th>
<th>Old companies</th>
<th>Large employer</th>
<th>Small employer</th>
<th>Large revenue &gt;$200 million</th>
<th>Small revenue &lt;$200 million</th>
<th>Union</th>
<th>Non-union</th>
<th>Building</th>
<th>Civil</th>
<th>North states</th>
<th>South states</th>
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<td>Safety goals are set before safety training</td>
<td>3.3 3.2 3.2 3.4 3.3 3.4 3.3 3.4</td>
<td>3.4 3.3 3.3 3.6 3.5 3.4 3.4 3.5</td>
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<td>Middle management participates in safety training</td>
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<td>Feedback is provided to workers</td>
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<td>3.6</td>
<td>3.5</td>
<td>3.4</td>
<td>3.4</td>
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<td>Visual aids are used</td>
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<td>Content of training is designed to satisfy worker needs/interests</td>
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<td>3.4</td>
<td>*</td>
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<td>3.2</td>
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<td>The safety-related behaviors of workers are observed</td>
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<td>3.1</td>
<td>3.1</td>
<td>3.1</td>
<td>3.0</td>
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<td>2.7</td>
<td>*</td>
<td>3.5</td>
<td>* 3.0 3.2</td>
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<td>Workers are aware of the critical safety issues</td>
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<td>3.0</td>
<td>3.1</td>
<td>3.0</td>
<td>3.0</td>
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<td>Pride in work completed without accidents is a motivating factor</td>
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<td>3.0</td>
<td>2.9</td>
<td>3.1</td>
<td>2.9</td>
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<td>3.0</td>
<td>2.9</td>
<td>3.0</td>
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<tr>
<td>Attending safety training motivates workers to follow safety rules</td>
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<td>2.9</td>
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<td>2.9</td>
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<td>2.9</td>
<td>3.0</td>
<td>2.9</td>
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<td>Daily safety training is provided</td>
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<td>3.0</td>
<td>3.1</td>
<td>2.8</td>
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<td>2.9</td>
<td>2.8</td>
<td>3.0</td>
<td>2.9</td>
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<tr>
<td>Experienced workers share their safety knowledge with inexperienced workers</td>
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<td>2.8</td>
<td>2.8</td>
<td>2.9</td>
<td>2.7</td>
<td>3.0</td>
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<td>2.9</td>
<td>2.8</td>
<td>2.9</td>
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<td>Exams are administered to workers during or after safety training</td>
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<td>2.8</td>
<td>2.9</td>
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<tr>
<td>Only safety-trained workers are hired</td>
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<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
<td>2.0</td>
<td>2.3</td>
<td>2.1</td>
<td>2.2</td>
<td>2.0</td>
<td>2.3</td>
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<tr>
<td>Workers who have completed safety training are rewarded</td>
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<td>1.9</td>
<td>1.9</td>
<td>2.1</td>
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<td>2.0</td>
<td>2.1</td>
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<td>Only English speakers are hired</td>
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<td>1.8</td>
<td>1.7</td>
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* Statistically significant difference at α = 0.05.
relative to safety issues. For example, Byler (2013) reports that foreign born Hispanic/Latino workers were involved in 66% of all fatal accidents among all Hispanic/Latino workers. Also, according to studies conducted by Orrenius and Madeline (2009) and Hersch and Viscusi (2010), immigrants experience higher fatality and injury rates than natives at the workplace because limited English speaking ability makes immigrants less likely to learn about job risks. Several researchers also emphasize that employers might not explain job risks with sufficient detail and emphasis because of communication problems with immigrants whose native language is not English (Bender et al., 2006; Sandy and Elliott, 1996). The respondents reported that they solve language problems by using visual aids, providing translators in training sessions, and providing safety guidelines written in workers’ own language.

The study also showed that when the findings are analyzed from the point of view of young vs. old firms, large vs. small employers, companies with large vs. small annual turnover, union vs. non-union companies, building vs. civil contractors, and companies located in southern vs. northern states, very few statistically significant differences are observed. The few significant differences are easily explained by the fact that the original population that was surveyed included the largest 400 companies in the U.S.

This study is a good reference for those who research the effectiveness of “learning” in safety training sessions. It points out that employers may have the best intentions in mind when organizing safety training, but that their objective of improving site safety may not be achieved unless they pay special attention to the effectiveness of learning during training sessions. Sensitivity on the part of employers to organizational, feedback, content, process, and worker issues in safety training may help improve site safety. Although the language barrier faced by non-English speaking workers has been rarely investigated in the literature, this paper also broadly discusses this challenge. The study is of benefit to project managers as it allows them to set and monitor effective safety training strategies as part of their safety management responsibilities.

One should note that the survey has been administered only to large contractors in the U.S. Future studies can be conducted by administering similar surveys to a larger cross-section of the construction industry (not only the top 400). After all, the many specialty contractors are typically smaller than the top 400 companies, and yet they collectively perform a large portion of the construction volume and employ/train a large number of workers. Future work can also include correlating the results of such surveys with worker demographics, and with each company’s “experience modification” ratings issued by

![Figure 3. Average responses to Question 2 “how do you solve language problems for non-English speakers while training them for safety?”](image)

<table>
<thead>
<tr>
<th>Survey items</th>
<th>Young companies &lt;60 years</th>
<th>Old companies &gt;60 years</th>
<th>Large employer &gt;300</th>
<th>Small employer &lt;300</th>
<th>Large revenue&gt;$200 million</th>
<th>Small revenue&lt;$200 million</th>
<th>Union</th>
<th>Non-union</th>
<th>Building</th>
<th>Civil works</th>
<th>North states</th>
<th>South states</th>
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<tbody>
<tr>
<td>Use of visual aids</td>
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<td>3.3</td>
<td>2.9</td>
<td>3.1</td>
<td>2.8</td>
<td>3.0</td>
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<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Use of translators</td>
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<td>2.7</td>
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<td>2.6</td>
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<td>Training given in workers’ own language</td>
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<tr>
<td>Guidelines in workers’ own language</td>
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<td>2.0</td>
<td>2.4</td>
<td>2.4</td>
<td>2.5</td>
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<tr>
<td>Preference for workers who speak English</td>
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<td>1.9</td>
<td>2.0</td>
<td>1.9</td>
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<td>2.1</td>
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<td>More frequent and rigorous training for non-English speakers</td>
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<td>1.8</td>
<td>1.8</td>
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<tr>
<td>Non-English speakers more likely to be in accidents</td>
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<td>1.7</td>
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<td>English language courses to non-English speakers</td>
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<td>1.7</td>
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<td>1.5</td>
<td>1.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

* Statistically significant difference at $\alpha = 0.05$. 

Workers’ Compensation Insurance. It would also be interesting to directly measure in future research how much workers actually implement what they learn in training sessions.

Conflict of Interest

There is no conflict of interest.

References


Ruttenberg, R., Lazo, M., 2004. Spanish-speaking construction workers discuss their safety needs and experiences. The Center to Protect Workers’ Rights. Silver Spring, MD.


