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As zero-accidents cultures expand in popularity, knowledge and implementation of safety regulations have become priorities for construction organizations. An expanded literature review revealed that many industry leaders have responded by increasing the frequency and content of health and safety training programmes; however the provision of training largely has remained consistent. Identifying workers' conceptions of the training they receive is critical to the design and deployment of effective workplace education programmes. Utilizing a hybrid questionnaire of qualitative and quantitative components to assess perceptions and knowledge, data were collected from a sample (n = 121) representing construction professionals across the United States who had completed an OSHA 10-Hour Construction Safety Training Course. The data described a workforce dissatisfied with training effectiveness and characterized a widespread situation in which the distinguishing characteristics of adult learning had not been addressed by qualified trainers. Strong health and safety training programmes improve employee retention as well as compliance with health and safety requirements. Trainees are more likely to respond positively to training programmes when adult learning theories are integrated into safety trainer readiness programmes.

Keywords: Safety, training, construction education, learning.

Introduction

In 2009 the construction industry was responsible for approximately 19% of the deaths which occurred in the United States as a result of injuries sustained in the workplace, while the rate of non-fatal injuries attributable to occupational hazards was 4.3 cases per 100 people (Bureau of Labor Statistics, 2010). Although statistics have since shown slight improvement, it is apparent that non-compliance with safety procedures and inadequately delivered training are among the key factors resulting in such a high rate of injury and fatality in this sector. Additionally, there are financial costs associated with inadequate provision of training in the form of working days missed annually as a consequence of occupational injury. According to industry experts many of these injuries and fatalities would be completely avoidable if only good safety practice were to be observed. Poor training and poor retention of relevant knowledge among construction workers are two factors responsible for this high incidence of injury. It would therefore be of great value to the industry, both financially and for the benefit of the workforce, to conduct a thorough review of training practices in the United States and make recommendations for enhanced delivery.

In what follows, the results of an initial survey of the problems facing the industry are presented. As the problem is substantial, not all the relevant causes for concern can be addressed here, but in the concluding section further avenues for enquiry will be suggested for a more extensive report. Commentary is provided on the importance of involving contemporary adult learning theory in the delivery of improved workplace training programmes—a key improvement suggested by the results of the survey. By accepting the recommendations made in this article, the industry can reduce the damage caused by avoidable injury and fatality and, in so doing, enhance working conditions

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that engender a culture among workers which places additional value on the training they receive.

Literature review

Wilson (1989) drew attention to the impermanence of employment in the construction industry in the United States, citing a structure reliant on temporary contracts and extensive outsourcing. From this he extrapolated the importance of ensuring that the workforce was trained to a standard such that its members could move from one job to the next with a strong awareness of what constituted safe and correct practice, thereby minimizing the risks to themselves and others associated with the temporary structures and unstable environments which characterize their profession. Wilson (1989) indicated that site managers and 93% of owners agreed that most accidents were caused by human factors rather than working conditions. He views professional development and training of the workforce as integral to reducing the number and severity of accidents that occur. He further comments that the workforce in 1989 did not view safety legislation as credible and often found it difficult to understand and implement effectively.

Among the recommendations for improvement within the industry, Wilson (1989) argued for making legislation more understandable to the layman; improving the level of education and formal training available; providing a greater abundance of applicable information and disseminating that information more widely; improving the method for passing on safety information through example; and making greater use of experience in the industry with regard to suggestions for improvement. In order to assess the extent to which the recommendations have since been implemented, and the changes which have since taken place in the field of workplace safety training, it has been necessary to conduct primary research and assess the results in conjunction with Wilson's recommendations.

In the last two decades certain reforms have taken place which vindicate Wilson's agenda and have helped reduce the overall incidence of avoidable injury and fatality. Gillette (2004) quoted Buddy Edens, president of Mississippi Associated Builders and Contractors, saying, 'Contractors realise the importance of safety ... A safe workplace adds to their bottom line' (p. 26). This observation suggests a widespread acceptance of Wilson's dictum that safety improvements depend on the willingness of the workforce to engage with the issue of training and accident prevention techniques. A 2008 article provided one example of how training in the proper use of safety equipment can make a substantial difference, estimating that 90% of injuries to eyes could be avoided by using appropriate eye protection properly (Ops & Maintenance, 2008). Sitek (2009) draws attention to the point that 'a history of accident-free work days is an asset when negotiating insurance packages' (p. 16), further supporting the view that a higher standard of training benefits the long-term profitability of employers.

Literacy and workplace learning

Workplace training is, by its nature, designed to educate adults from various backgrounds who will consequently face different challenges. The role of trainers is, therefore, twofold, in that they are required both to disseminate material *and* to tailor their teaching style to suit the requirements of each particular trainee. In the course of developing instructional methods, trainers must consider the value of andragogical theory in the training of more mature trainees. It will be of benefit to them to have access to data that quantify the significance of this approach in particular. The term *andragogy*, used in this context, refers to techniques used to educate adults through facilitation, while *pedagogy* is generally associated with K-12 instruction. Andragogy, as a learning theory, was introduced to the United States by Malcolm Knowles, who defined the term as 'the art and science of helping adults learn' (Kaufman, 2003, p. 213). It derives from the term *Andragogik*, coined by German educator Alexander Kapp in 1833 and refers to the education of adults (Stähli, 2005). Unlike pedagogy, which typically involves the proper use of teaching strategies and styles of instruction to educate children or teenagers, andragogy involves the trainer helping adults to learn through facilitation rather than dictation. Andragogical methods have frequently been found effective in retraining individuals to adapt to new jobs and in supporting the learning of those whose capacity for conventional academic learning is in doubt.

Literacy deficits among construction workers

A significant amount of literature exists on literacy and the overall literacy deficit that exists in the construction industry. The problem presents an enormous barrier for trainers. Crowley and Lutz (1997) found that 27% of those surveyed performed at the lowest level of 'document literacy' and 20% performed at the lowest level of 'quantitative literacy'.

According to the Center for Construction Research and Training (2007), workers in the construction industry in 2007 had a lower level of educational attainment than those employed in other industries. In 2005, 27% of construction production workers did not have a high school diploma, 45% had a high school diploma but nothing more advanced, and only 28% had undertaken some form of post-secondary education. Hispanic workers educated at post-secondary level were particularly underrepresented. The demographics and diversity of the construction industry—including age, experience, culture, race, gender, educational attainment, levels of literacy, English as a second language and learning disabilities—have to be taken into consideration when developing safety training methods. As we shall see, participants in our survey responded positively to any attempt to address these characteristics when preparing and disseminating instructional materials.

Potential benefits of learner-focused safety training

According to Yoshimoto *et al*. (2007), andragogical approaches are learner-focused and they emphasize the need for learner support while pedagogical approaches are teacher-focused and concentrate more on the idea of teaching. In a critique of pedagogy, Bedi (2004) indicated that pedagogical approaches make learners submissive as the teacher makes all of the decisions about the educational experience, thus limiting the trainees' capacity to take the initiative to define their own learning goals.

Hallowell (2010) claims, 'the most cost-effective safety programme elements are subcontractor selection and management and upper management support and commitment' (p. 25). According to him, staffing a full-time safety manager and record keeping are the least cost-effective elements. Hallowell examined the cost of 13 elements of safety management programmes and attempted to establish which were the most proportionately cost-effective in an industry characterized by dynamic work environments. He cited evidence that management regimes were most likely to invest in accident-prevention measures proven to be cost effective. Ultimately, it was recommended that emphasis be placed on selecting adequately trained subcontractors to undertake work in the sector and involving management more actively in ensuring good practice. Finally, an increasingly relevant concern is the provision of training for the rising Hispanic constituency in the workforce. Although cultural differences will exist in any workforce, the possibility of dealing with a language barrier in delivering instruction is particularly acute when one considers the high incidence of immigration and its effect on this sector in recent years. Where training is currently delivered only in English, this may impede understanding and endanger others in the workplace. In the study discussed below (issued to participants in English and Spanish versions) this issue of a language barrier which exists between otherwise comparably capable trainees was examined.

Method

Research design

The purpose of this exploratory study was to examine and describe workers' perceptions of health and safety training programmes in the construction industry. To obtain the data used in this study, a hybrid quantitative and qualitative questionnaire was developed so that questions which could not be addressed by the quantitative design alone could be assessed by analysing responses collected using the supporting qualitative component. Tashakkori and Teddlie (1998) recommended merging a quantitative research design with a qualitative component in order to obtain the most comprehensive insight possible, and to allow for the extrapolation of conclusions by triangulating responses. Theirs was the model which was followed when designing this survey. The descriptive design was appropriate since the purpose was simply to detect and report patterns in the data rather than to determine specific associations or implications (Cozby, 2001).

The questionnaire incorporated several multiple-choice questions and Likert items designed to produce discrete data for analysis. The questionnaire also included open-ended questions soliciting qualitative responses. The intention behind including these qualitative elements was to alert the researcher to common themes, not anticipated in the design of the questionnaire. The remit of the research conducted was determined in consultation with Michael Voudouris, President of the New York City Chapter of the American Society of Safety Engineers and expert in the field of construction safety.

Questionnaire design

The questionnaire was composed of three sections. Sections 1 and 2 were designed to collect quantitative data, while section 3 was included to collect qualitative data. Information gathered in the first section was used to provide a general demographic breakdown of respondents; data from the second section allowed

the assessment of the level of knowledge and understanding displayed by respondents; the final section provided personal insights and allows us to qualify the picture presented in sections one and two.

Section 1 (quantitative)
Questions in this first section were designed to capture general information about participants. They were asked to report their gender, age and number of years working in the industry. They were also asked to indicate the principal reason why they undertook the OSHA 10-Hour Construction Safety Training Course. Thirdly, respondents were quizzed as to the details of any financial support they received to offset the costs of training. Finally, respondents were required to indicate whether they had completed the training in face-to-face or online format.

Section 2 (quantitative)
The level of knowledge displayed by respondents was evaluated by presenting questions which addressed major topics covered as part of the OSHA 10-Hour Construction Safety Training Course. These topics included *Introduction to OSHA*, *Fall Protection*, *Electrical*, *Struck by*, *Caught In / Between* and *Personal Protective and Lifesaving Equipment* (Occupational Safety and Health Administration, 2011). Since the *Introduction to OSHA* portion of the course contains more than twice as much information as other units, nine questions were created based on this topic. Five questions were created for each of the remaining five units. The questionnaire ultimately presented respondents with a total of 34 questions in this section.

Section 3 (qualitative)
In this section of the questionnaire, participants were asked to describe the kinds of situations and experiences that make them want to comply with safety regulations in the construction industry. They were also asked to describe the value of the OSHA 10-Hour Construction Safety Training Course and its relevance to their experience. Finally, they were asked for their views on the question of whether employers should mandate their employees to undertake the OSHA 10-Hour Construction Safety Training Course.

Population and recruitment

The sample for the study was made up of general construction workers from across the United States. Respondents were expected to have varying levels of construction experience, frontline exposure, training and knowledge so that a sample that closely mirrored the current make-up of the construction workforce could be collected.

Fliers and advertisements were forwarded to 20 construction professionals representing different organizations throughout the United States. Each flyer displayed an easy-to-remember uniform resource locator (URL) that could be accessed from any personal computer with Internet access. Additional methods of outreach included reaching out to union directors, construction company managers and site safety inspectors. Hard copies of fliers were posted near active construction sites and advertisements were e-mailed to web-based forums dedicated to construction professionals. The intention was to cast the net as wide as possible and recruit participants from across the sector.

Sampling

The *a priori* sample size depended on the number of independent variables included in the model. Assuming a level of significance equal to 0.05, a power of 0.80, and a medium effect size ($f^2 = 0.15$) and assuming 10 independent variables, the minimum sample size required for the study was computed to be 118.

The questionnaire was accessed and begun 214 times, but only 140 were eventually completed. Therefore, the rate of abandonment was nearly 35%. After data cleaning functions were performed the sample included construction workers with experience ranging from general labour to upper management. The sample only represented construction employees aged 18 years or over at the time the study was conducted. Only respondents who had completed an OSHA 10-Hour Construction Safety Training Course were included in the study. Respondents who indicated completion of both OSHA 10- and 30-Hour Construction Safety Training Courses were required to affirm they would respond to items on the questionnaire based on their experience with the 10-Hour Course, and any participants who were unable to agree to this condition were not included in the sample.

A non-probability and purposive sampling plan was used to identify 'information-rich cases' for the study and to obtain a representative sample (Patton, 2001, p. 242). This sampling plan was appropriate because participants were not randomly selected from the entire population of construction workers, but were rather selected based on whether they voluntarily chose to participate in the study.

Results

Demographics and general trends

The sample (n = 121) comprised workers of both genders (91% male, 9% female), with 80% participants that were born in the United States and 20% claiming to be foreign-born. The mean age of participants was 42 years old and the average amount of time spent in the construction industry for the sample was 15 years. The demographics of this sample closely resemble the make-up of the workforce of the construction industry in the United States.

Worker motivation for training

When asked to identify why they had undertaken the OSHA 10-Hour Construction Safety Training Course, nearly 74% of respondents indicated that they participated in the programme because of a requirement imposed by their employers, whereas 22% indicated that a personal desire to obtain a greater level of understanding of the regulations in place led them to enrol on the course. It was further demonstrated that 57% of respondents had been funded by their employers while undertaking the training, whereas 16% indicated that they paid for their own training, 12% were funded by the Labour Unions to which they belonged, and the remaining respondents were oblivious to specifics relating to payment for the course. Although a majority of respondents were financially supported through the training process, nearly 17% were compelled by their employers to enrol on the course while not in receipt of any funding from those employers to support their studies. Seven per cent (7%) of respondents indicated support for the view that management should pay for the course if they mandate it. Ten per cent (10%) of respondents elected to complete the training online, although it is not clear how many of the remainder were aware of the opportunity to do this.

Worker perceptions about management and training

Eleven per cent (11%) of respondents indicated support for the view that management does not sufficiently care about employee safety, although other answers did speak to a sense of mutual responsibility shared by managers and the workforce: evidently, attitudes differ broadly across the sector. There was a positive correlation between higher scores achieved on the knowledge section of the questionnaire and the fact of workers being obliged to pay for their own training, with those obliged to fund their own training scoring better during examination.

Among respondents, some 13% expressed dissatisfaction with the course, but stated that this response was not tied to a concern with managers and their expectations. Several within the sample stipulated that the training ought to be delivered in Spanish for those who do not speak fluent English. Others were simply dissatisfied with the conduct and ability of trainers. Whereas 52% of respondents replied that communication issues were not a barrier to safety on the job, some Hispanic workers who did not have a Spanish-speaking supervisor indicated that they relied on other forms of communication such as interpretation by co-workers or sign language, which may be inadequate for communicating about health and safety practices.

Knowledge retention and effectiveness of training

The idea of self-directed learning as a motivating factor among adults was measured. Those who chose to complete the training of their own volition typically performed better during examination. Of a potential maximum score of 34 (100%), the mean score among this group was 22 ($SD = 8$), compared to a mean score of 17 ($SD = 8$) achieved by those who took the course for other reasons. Those who specified a mandate from their employer as being among those reasons achieved a mean score on the knowledge section of 16 ($SD = 8$).

Responses to a subsequent question showed that fewer than half of all recipients—49%—were prepared to commit to the statement either that they 'agreed' or 'strongly agreed' that they had understood the material covered in the training. Furthermore, 32% either 'disagreed' or 'strongly disagreed' with having understood the material covered in the training, with 19% declaring a neutral response.

Efficacy of trainer and training methods

Forty-one per cent (41%) of respondents contended that their trainers were either 'ineffective' or 'very ineffective', with 29% calling them 'effective' or 'very effective'. Nearly one-third (29%) expressed no opinion in either direction. This verdict extended also to the literature made available in the course of training, with a small majority of respondents—39%—referring to the materials as either 'effective' or 'very effective' while almost 32% rated them either 'ineffective' or 'very ineffective', and 29% were unwilling to commit to a position.

Convenience

Questions were posed regarding the provision of training and how convenient participants had found the process overall. Over half the respondents (53%) specified that training was delivered at inconvenient times and this may perhaps contribute to a lack of retentiveness among learners.

Relevance

Seventeen per cent (17%) of respondents called the training delivered in the OSHA 10-Hour course either 'irrelevant' or 'a waste of time', with specific targeted remarks directed at the ways in which material included differed from their professional experiences and was therefore of little practical use to them. A marginally significant relationship between years of construction experience in the United States and higher scores in the knowledge section was identified, where greater experience correlated with reduced knowledge scores, $r = -0.17$, $p = 0.06$.

The proposition 'The training you received was relevant to your work experience' drew approval from 32.5% of respondents, while a slightly larger proportion, 35%, disagreed. Nearly one-third (33%) refused to specify a position, suggesting that the material did not distinguish itself as relevant, even if they were reluctant to objectively deny that relevance.

Overall compliance with safety regulations

When asked to specify the factors which make one want to comply with safety regulations, 43% of respondents stated that fear of injury, including instinctive self-preservation, was their main reason for following safety standards in the workplace—and, consequently, for responding to training. Responsibility for others—a related theme—was selected by 24% of respondents, while 12% specified career concerns (it is costly to be inadvertently injured, and there may be penalties applied if improper practice is followed in maintaining safety standards), and 2% claimed to value learning for its own sake first and foremost. The remaining respondents declined to answer.

Discussion of results

The results of this study raise a series of related questions about the standard, means of delivery and perception of workplace training for construction workers. The figures relating to reasons why participants attended the OSHA 10-Hour Construction Safety Training Course raised questions about the culture in which training is delivered. In a significant portion of cases, training was mandatory but not funded by employers. There is also a concern that where training is not mandatory, workers will not participate because of the personal financial impact involved.

Argument for self-directed learning

The results do demonstrate that among those who can afford the training, those who undertake it of their own volition typically retain the knowledge acquired through the course for longer. This correlation supports the case for self-directed learning and indicates that the challenge for those seeking to improve standards of knowledge and compliance with safety regulations within the industry is to advance a culture which values training irrespective of pressure from an employer. The widespread distrust of management is also worth exploring, since a more constructive relationship between employers and the workforce would undoubtedly contribute to a stronger sense of mutual responsibility—a feeling which engenders an awareness of the health and safety concerns of others.

Trainer characteristics

The figures for participants committing to the statement that they understood the material covered in the training course are less than encouraging, indicating that while the content of the OSHA 10-Hour Construction Safety Training Course may have the potential to improve compliance with regulations, the manner in which it is delivered inhibits workers' understanding of health and safety in the workplace. Much of the ineffective delivery appears attributable either to the calibre of trainer delivering the course or to trainees' *perceptions* of their trainers' competence. It is self-evident that a workforce more confident in the competence of its trainers and more secure in valuing the teaching aids made available to it will be more compliant with the procedures taught in courses such as the OSHA 10-Hour Construction Safety Training Course. Therefore, in seeking to address the worrying trend of non-compliance with safety standards, it is vital to implement a system which both inspires confidence and incorporates the expertise of well-trained and capable teachers equipped with appropriate materials to make the best use of the time available to them and their trainees.

The results show that paying for their own training increases the motivation to do well among employees,

an idea supported by cognitive dissonance theory (Festinger, 1957). The theory holds that maintaining two conflicting ideas simultaneously is psychologically difficult and that learners will take steps to adjust their behaviour in order to diminish this sense of dissonance. Thus if learners feel that their expectations and experience differ dramatically they will become de-motivated. By funding their own training and taking responsibility for their personal development, they alter their expectations accordingly and become psychologically motivated on account of their having avoided cognitive dissonance.

The challenge in responding to these figures is assessing the accuracy of workers' perceptions regarding the suitability of their trainers. In cases where course content is being inadequately delivered, it may be possible either to retrain or to replace the trainer. However, in cases where trainers may be found competent by an outside observer, but are not trusted or respected by trainees, a more nuanced approach is required. It is important to ensure both that a trainer is capable and convincing and that content is delivered in an engaging manner. These observations again support the case for self-directed, andragogical training, in which trainers cultivate the respect of their trainees by facilitating them in the learning process rather than actively teaching in a more traditional, didactic way.

It is apparent from a series of related studies that adult learners are protective of their time and keen to pursue training only in so far as it can be accommodated by their other priorities (Grupe and Connelly, 1995; Kelly, 2006). The statistics obtained from this research demonstrate that a high proportion of learners are not satisfied that training is currently delivered in a convenient way. Here there is certainly room for improvement, and working in conjunction with management will be important in delivering higher standards. Investment in learners is repaid in the long term by a reduction in the costs associated with accidental injury and damage which the proper training can render avoidable.

The diverse demographic make-up of the workforce is significant, particularly with respect to discrepancies in age and experience. Just as familiarity with good practice is a positive element of training, bad or outmoded habits may negatively impact upon an employee's ability to comply with and retain information regarding health and safety regulations. Such a phenomenon was evident in this survey in the correlation between longer service and poorer scores on the knowledge section of the questionnaire. Given that all participants in the study had undergone at least the same OSHA 10-Hour Construction Safety Training Course, this relationship, while slight, may suggest that methods which succeed with those less experienced in the industry are less effective in the training of those with lengthier service records. This foregrounds the importance of personally targeted provision of training. Presenting information using andragogy would make it appear more relevant from the trainees' point of view by drawing examples from and parallels with their working experience.

The responses to the question about the relevance of the material covered in training require further comment, as they once again suggest a problem with perception, with many learners unwilling or unable to see the applicability of theoretical content taught during training in a practical workplace environment. This dissociation between theory and practice can be addressed in any delivery reforms which result from this analysis. The high proportion of respondents who claimed that material was not relevant suggests that important lessons were not understood or that they were not being taught, and the quality of the training may have been lacking. Steps should be taken to address this disconnect between training and the workplace, and these can be determined by an exploration of the motivating factors which govern trainees.

In the majority of cases where fear of injury was the dominant motivating factor, most workers had either heard a cautionary tale from a colleague or personally experienced a career-related injury. Relating these first- and second-hand experiences to the third-hand context of a training session is a key challenge facing trainers, and emphasizes again the importance of delivering relevant content specific to the experience of each individual trainee. There may be a case for delivering less training in an artificial *classroom* environment and more in the workplace, where the practical ramifications of a failure to adhere to safety regulations are more immediately apparent. Here again, andragogy seemingly supersedes pedagogy as the most appropriate instructional method.

It is worth noting that the two most common motivating factors here specified—fear of injury and fear for one's livelihood—constitute the two most basic levels of motivation described in Maslow's hierarchy (Maslow, 1943): psychological and safety needs. It is clear from this observation that training in the construction industry should recognize these fundamental factors which influence learners and respond to them actively. The issue of a worker's livelihood is doubly significant, since the costs of a high standard of training are so high and a balance is often sought between the need to be trained in order to work with limited fear of injury and a concern about the cost of training and the opportunity cost of days spent in training and professional development. Unfortunately, such a balance means that the quality of a worker's training is

necessarily compromised by a concern to save money and maintain a high standard of productivity. The costs involved are proportionately more significant when dealing with freelance contractors than those who work in construction organizations, and the only ways to address this disparity may be to increase the minimum required safety standards, standardize a method of assessment and ongoing review, and examine the feasibility of obtaining public subsidy to offset the short-term costs to individuals and organizations on the understanding that productivity will increase dramatically in the long term.

Conclusions

In an attempt to encourage more employees to follow construction industry safety regulations, successfully conveying to trainees the dangerous conditions and possibility of injury would theoretically return the highest level of compliance. The practical difficulty here is the variety of training strategies out there and the challenge of incorporating relevant material in all of these, given the diverse demographic make-up of the workforce. Results clearly show that greater understanding correlates directly to better practice, and if the material included in the training programme is relevant to the individual, the potential for that learning to be comprehensive in scope increases dramatically. It is therefore an investment for employers and one with potentially high returns both in financial and human terms. This conclusion echoes those of Hallowell (2010), who states that the implementation of good health and safety practice results 'in a reduction of recordable injury rates' (p. 33). This cost-effective outcome emphasizes the need to take steps to improve health and safety practice across the industry (Sitek, 2009).

Digital learning as a solution

One developing area for consideration is the online delivery of training. The benefits are potentially significant, in terms of reduced costs, convenience for the trainee (a highly valued commodity, as these results demonstrate) and scope for flexible delivery. Nevertheless, to rely too heavily on this developing method of instruction would be fraught with risk. The absence of a personal, face-to-face relationship between trainee and trainer allows for the possibility that a lack of understanding on the part of the former might easily go unnoticed by the latter. Moreover the potential for taking shortcuts in learning methods, relying heavily on search engines rather than personal understanding, and even cheating on examinations is considerable. These practical difficulties limit the utility of digital media. The online medium is hugely valuable, but also largely untested, and the initial cost-cutting effect may prove to be misleading if it is ultimately no substitute for face-to-face interactive instruction. Digital instruction does, however, have much to offer in an industry which remains diverse and heavily reliant on contractors who are often between jobs (Wilson, 1989).

Developing lessons that relate to trainees' specific duties in construction

In order for training to be effective for adults, trainees must consider the content covered to be relevant to their lives (Aik and Tway, 2006), it must be presented by a trainer who seems knowledgeable about the subject being taught, and it must be supplemented by tangible materials that are understandable (Hornik, 2008). The primary data collected in this exploratory study indicated that these basic concepts of adult education are not always met during the provision of OSHA 10-Hour Construction Safety Training sessions.

Crucially, a higher standard of *instructor training* must be developed and implemented by experts with a comprehensive appreciation of contemporary adult learning theory. At present, the fact that fewer than half (48.7%) of all respondents claimed to understand the knowledge communicated in the OSHA 10-Hour Construction Safety Training Course suggests an inadequate instructional method. In order to improve this record, it is important that the requirements to qualify as an Authorized Construction Industry Outreach Trainer should include an appreciation of training strategies that focus specifically on literacy, adult learning methods and the delivery of material which is not only relevant in theory, but perceived to be relevant by the learner. As demonstrated in this survey, the perception that a trainer is weak or ill-informed is as damaging to understanding and retention of material among trainees as the reality of such weakness.

Raising requirements to become an authorized trainer

Under the present system, OSHA 10-Hour Construction Safety Training Courses are delivered by OSHA-authorized personnel who have themselves undergone a Trainer Course in Occupational Safety and Health Standards for the Construction Industry (OSHA Course #500) and another course in Occupational

Safety and Health Standards for the Construction Industry (OSHA Course #510). Both courses offer very little in terms of developing instructional strategies or facilitating effective learning experiences for audiences, and neither properly explores the andragogic method. The only other prerequisite for authorization is five years of construction safety experience, but prospective trainers may be otherwise untrained, with no expertise to speak of in the fields of curriculum development, educational psychology or adult education. As we have seen, experience alone is not sufficient guarantee of a good working knowledge of health and safety regulations.

This lack of relevant experience among qualified trainers suggests a culture which values high standards of safety compliance without properly understanding how these are best achieved. In order to improve the calibre of trainer available, it would be beneficial if trainers were obliged to acquaint themselves with the prevailing wisdom among professional educators, which places strong emphasis on learner-driven learning, especially among mature students.

Experience in the industry and the ability to teach others are entirely different qualities and the system should recognize this in order to limit the perception among trainees that their trainers are inadequately capable. Therefore, those who enrol on trainer courses would benefit from having completed some form of post-secondary education, just like K-12 educators. Self-evidently this higher educational benchmark may necessitate a greater cost to the industry and to freelance contractors who require training, but that cost would be offset by safety benefits and lives saved in consequence of this change, as argued by Sitek (2009). It may be possible to secure subsidies for this, with support from industry leaders and political campaign groups. Since construction safety either directly or indirectly affects taxpayers, all of whom benefit from the product of the industry, a strong case could be made that it is in the public interest to subsidize a higher standard of employee care in this field. Clearly the requirement for a higher standard of training would create barriers to entry for many otherwise qualified trainers, but, as demonstrated here, the current standards are still too low, and the present system is therefore unsustainable.

Limitations affecting this study

As stated at the outset, this survey was designed to be exploratory and, while valuable, the data gathered are not of unlimited use. The present study experienced a weakness in terms of recruitment and survey abandonment. Many potential participants indicated that they were not comfortable using a computer (the questionnaire was only available in an online format), and did not feel comfortable with completing an electronic questionnaire via a personal computer. The online questionnaire was accessed and begun 214 times, but only 140 questionnaires were marked as complete, marking the rate of abandonment at 34.6%. The length of the questionnaire may have contributed to the rate of abandonment, along with the medium through which it was delivered.

Suggestions for future research

The scope of this exploratory study was limited to exploring construction workers' knowledge of and attitude towards safety regulations as covered in a specific OSHA training course. In order to improve safety standards across the industry, more extensive research and data gathering needs to take place. Specific gaps in knowledge, and the trends which localize these gaps to particular areas of the demographic can be identified and addressed, and strategies suggested for eliminating those gaps. A study might valuably be conducted which samples *safety instructors* and seeks to assess and account for their various levels of knowledge, skill and motivation. It would also be beneficial to conduct research into the practical ramifications of several of the recommendations made here on a local and national scale.

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