ЕКОНОМИКА
ISSN 0350-137X, EISSN 2334-9190, UDK 338 (497,1)
Vol. 71, april-june 2025, № 1
P. 13-22

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ORIGINAL SCIENTIFIC ARTICLE
DOI: 10.5937/ekonomika2502013B
Received: March 17, 2025
Accepted: April 18, 2025

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THE INFLUENCE OF OCCUPATIONAL SAFETY TRAINING MANAGEMENT ON THE PERCEPTION OF SAFETY AMONG CONSTRUCTION WORKERS

Abstract

Construction is one of the riskiest professions and unfortunately, every year a large number of deaths and injuries are reported during the performance of work tasks. Legal regulations mandate that all workers undergo mandatory occupational safety and health training, but there is still a certain number of workers who are untrained and without adequate knowledge and skills to perform the given work. Working at height in the construction industry is one of the most dangerous professions and must not be performed without proper equipment or without the use of protective devices. Occupational safety and health training reduces accidents and fatalities and should be designed and implemented in a way that enables employees to identify and effectively eliminate hazards. In this paper, research was carried out, in which 7 questions were asked to two groups of workers about: safety knowledge, safety behavior, self-confidence and safety awareness, commitment, risk acceptance, work practices, and risk and accident reduction and it was concluded that workers with training showed a higher perception of safety and health at work compared to those workers without training.

Key words: Construction, safety at work, perception of safety

JEL classification: *J28, L74, M53*

УТИЦАЈ МЕНАЏМЕНТА ОБУКЕ ЗАШТИТЕ НА РАДУ НА ПРЕЦЕПЦИЈУ БЕЗБЕДНОСТИ МЕЂУ ГРАЂЕВИНСКИМ РАДНИЦИМА

Апстракт

Грађевинарство је једна од најризичнијих професија и, нажалост, сваке године се пријави велики број погинулих и повређених радника током обављања радних задатака. Законска регулатива налаже да сви радници

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прођу обавезну обуку из области безбедности и здравља на раду, али и даље постоји одређени број радника који су необучени и немају одговарајућа знања и вештине за обављање датог посла. Рад на висини у грађевинарству је једна од најопаснијих професија и не сме се обављати без одговарајуће опреме или без употребе заштитних средстава. Обука о безбедности и здрављу на раду смањује несреће и смртне случајеве и треба да буде осмишљена и спроведена на начин који омогућава запосленима да идентификују и ефикасно елиминишу опасности. У овом раду спроведено је истраживање у коме је постављено 7 питања двема групама радника о: знању о безбедности, безбедном понашању, самопоуздању и свести о безбедности, посвећености, прихватању ризика, радној пракси и смањењу ризика и незгода и закључено је да радници са обуком показују већу перцепцију безбедности и здравља на раду у поређењу са радницима без обуке.

Кључне речи: *Изградња, заштита на раду, перцепција безбедности*

Introduction

Considering that work is a significant part of people's lives and that people spend a large part of their time at work, occupational health and safety in any industry is of paramount importance (Gjorgjev & Byanov, 2022; Christian et al., 2009). Like some other professions, construction is a very risky profession and unfortunately, a large number of deaths and injuries are reported each year while performing work tasks (Dodoo & Al-Samarraie, 2019).

Although legal regulations require all workers to undergo mandatory training on occupational safety, there are still a certain number of workers who are untrained and lack the appropriate knowledge and skills to perform the given job (Taylor, 2015). For these reasons, in some industries and branches of industry there are still a significantly high number of accidents and deaths to this day (Ricci et al., 2016).

Working at height in the construction industry is one of the most dangerous professions, and one of the main hazards is falling. Current knowledge shows that falls from height are a problem that is encountered worldwide, with the construction industry being the one in which this risk is most often present (Guo et al., 2016; Evanoff et al., 2016). However, workers in other industries, such as the electrical industry, who are entrusted with installing, testing, repairing, monitoring and maintaining electrical equipment, are also at risk of falling from height. In addition, utility pole workers and communication tower technicians work at height, performing various tasks. Workers involved in commercial buildings, such as window cleaners, also have to work at significant heights (Dodoo & Al-Samarraie, 2019). Also, mountaineering instructors work at considerable heights and are exposed to the risk of falling, as are workers involved in forestry (Barling et al., 2003).

In addition to the loss of life and permanent disability, falls from height also affect the economic plan of countries and companies, all of which contributes to the prevention of falls becoming a top priority for company managements around the world (Borger et

al., 2011). Hence, we can say that there are many professions that require knowledge of safe working at height. Some of the construction site tasks associated with a high risk of causing injuries are (Sokas et al., 2009):

- erecting steel frames on large buildings
- erecting and dismantling scaffolding
- working on ladders that are not properly secured
- roofing
- dismantling machinery on the roof of a building
- welding carried out at height
- fixing pipes and painting at height.

Previous research suggests that occupational safety and health training reduces accidents and fatalities due to falls from height (Amde et al., 2019; Floyde et al., 2013; Nkomo et al., 2018; Vignoli et al., 2015; Taylor, 2015). During training, workers acquire knowledge such as (Leiter et al., 2009):

- recognition of dangerous situations and tasks where there is a risk of falling from a height
- correct selection of protective equipment for working at height
- method of checking the correctness of the equipment for working at height
- correct selection of the rope attachment points
- correct use of protective equipment
- understanding the limitations of protective equipment
- recognition of other hazards that may have an impact, such as slippery floors, toxic and suffocating gases, electrical hazards, etc.
- determination and reduction of the free fall distance
- interpretation of the evacuation plan.

Research also suggests that training should be repeated periodically.

Safety when working at height

Any work in which the performer could fall from one level to another and be injured is classified as work at height, which includes work (Ai Lin et al., 2005):

- above ground or floor level
- at an edge where a worker could fall through an opening or fragile surface
- above ground or floor level
- at ground level where a worker could fall through a hole or opening.

Working at height is very common in the construction industry and is classified as a very high-risk job. The largest number of fatal injuries at construction sites occur precisely due to falls from height and it is responsible for 28% of fatal and 7% of non-fatal injuries to workers worldwide (Edvards & Holt, 2008).

Work at height must not be performed without appropriate equipment or without the use of protective devices such as: safety baskets, platforms, safety nets, etc. In the event that the use of such equipment or devices is not possible due to the nature of the work, appropriate safety should be ensured in another way and by other means. The most

important factors for the successful and safe performance of work at height are compliance with the basic rules for safety at work and possession of the necessary equipment, use of personal protective equipment, training of workers and compliance with the prescribed measures during design, supervision and execution of the work. In this regard, the obligations and responsibilities fall on both the employer and the worker (Guo et al., 2016). The division of protection systems, according to the technique of working with equipment is: access restriction, work positioning, rope access and fall arrest.

Health and safety training is one way to enable employees to recognize and eliminate hazards in order to control risks in the workplace (Gjorgjev, 2023). To achieve this goal, training programs should be designed and implemented in such a way that they enable employees to identify hazards and effectively eliminate them through the successful involvement of employers, government and unions, if necessary. Health and safety training programs, which are designed according to legislation, help employees take action and reduce the risks that come with work (Mustard, 2019). Hence, occupational safety and health training provides an essential basis for educating employees about the risks in their workplaces.

Given the importance of occupational safety and health training, the most important question is what medium of instruction should be used to train employees. Some research has shown that the training program should be designed taking into account the level of education of the employees and the teaching should be at that level in order to be effective (Ricci et al., 2016). Research also shows that training of workers by colleagues achieves the best effectiveness. This type of training encourages and supports collective learning through problem solving, discussion and can sometimes give workers the knowledge and confidence to negotiate with employers to implement a workplace safety system (Slatin, 1995).

Statement of the problem, objective and task of the study

The main problem addressed by this research is whether occupational safety training in construction is effective in improving various aspects of safety when working at height and does it determine the impact of barriers and facilitating factors for the implementation of acquired occupational safety knowledge.

The aim of the research is to gain insights into the effectiveness of occupational safety training in construction, i.e., its impact on improving various aspects of safety when working at height, as well as the perception of obstacles and factors that hinder or facilitate the implementation of acquired occupational safety knowledge. In this regard, the differences between construction workers who have undergone training and those who have not undergone occupational safety training have been investigated in terms of safety knowledge, safety behavior, self-confidence and awareness, commitment to OSH, risk acceptance, work practices and the reduction of risks and accidents. The research also investigates the effectiveness of training in reducing or increasing the impact of hindering factors and facilitating factors for the application of the knowledge acquired from it.

Results and analysis

In order to observe the impact of construction workers' training on their perception of safety, research was conducted using survey questionnaires on two groups of workers of 30 respondents each, one with and the other without training. Seven questions were asked about: safety knowledge, safety behavior, self-confidence and safety awareness, commitment, risk acceptance, work practices, and risk and accident reduction. The collected data were processed using the SPSS software package and inferential statistics were applied, with a t-test for independent samples used to determine the statistical significance of differences between the arithmetic means of two groups of respondents.

Table 1 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of safety knowledge, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level of less than 0.01.

***Table 1**: Difference between workers with and without OSH training in terms of safety knowledge*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	3,906	,053	8,428	58	,000	4,667	,554	3,558	5,775
Equal variances not assumed			8,428	52,767	,000	4,667	,554	3,556	5,777

Table 2 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of safety behavior, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level of less than 0.01.

***Table 2**: Difference between workers with and without occupational safety and health training in terms of safety behavior*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	,531	,469	7,434	58	,000	3,767	,507	2,752	4,781
Equal variances not assumed			7,434	57,667	,000	3,767	,507	2,752	4,781

***Table 3**: Difference between workers with and without OSH training in terms of self-confidence and safety awareness*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1,503	,225	2,591	58	,012	1,133	,437	,258	2,009
Equal variances not assumed			2,591	56,345	,012	1,133	,437	,257	2,009

Table 3 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of self-confidence and safety awareness, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level less than 0.05 ($p = 0.012$).

***Table 4**: Difference between workers with and without OSH training in terms of commitment to occupational safety and health*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1,398	,242	4,545	58	,000	2,067	,455	1,157	2,977
Equal variances not assumed			4,545	55,750	,000	2,067	,455	1,156	2,978

Table 4 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of commitment to occupational safety and health, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level of less than 0.01.

***Table 5**: Difference between workers with and without OSH training in terms of risk acceptance at work*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	,483	,490	2,447	58	,017	,767	,313	,140	1,394
Equal variances not assumed			2,447	57,799	,017	,767	,313	,140	1,394

Table 5 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of risk acceptance at work, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level less than 0.05 (p = 0.017).

Table 6 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of work practices, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level of less than 0.01.

***Table 6**: Difference between workers with and without OSH training in terms of work practices*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	,053	,820	4,559	58	,000	3,467	,760	1,945	4,989
Equal variances not assumed			4,559	57,902	,000	3,467	,760	1,944	4,989

***Table** 7: Difference between workers with and without OSH training in terms of risk and accident reduction*

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1,401	,241	6,323	58	,000	2,567	,406	1,754	3,379
Equal variances not assumed			6,323	55,187	,000	2,567	,406	1,753	3,380

Table 7 contains the result of the t-test for the statistical significance of the obtained difference in the arithmetic means between the two groups of workers, in terms of risk and accident reduction, proving that there is a statistically significant difference between workers who have OSH training compared to their colleagues who have no training, at a level of less than 0.01.

The results of the research show that across all questions, workers with training showed a greater perception of occupational safety and health than those workers without training.

Conclusion and recommendations

Construction is a very risky profession and unfortunately, a large number of deaths and injuries are reported every year while performing work tasks. Although legal regulations require all workers to undergo mandatory training on occupational safety, there are still a certain number of workers who are untrained and lack the appropriate knowledge and skills to perform the given work.

Working at height in the construction industry is one of the most dangerous professions, and one of the main hazards is falling. Working at height must not be performed without appropriate equipment or without the use of protective devices such as: safety baskets, platforms, safety nets, etc.

Previous research suggests that occupational safety and health training reduces accidents and fatalities due to falls from height. Health and safety training is one way to enable employees to recognize and eliminate hazards in order to control risks in the workplace. To achieve this goal, training programs should be designed and implemented in such a way that they enable employees to identify hazards and eliminate them effectively through the successful involvement of employers, government and unions, if necessary.

In this paper, research was conducted using questionnaires on two groups of workers of 30 respondents each, one with and the other without training. In doing so, 7 questions were asked about: safety knowledge, safety behavior, self-confidence and

safety awareness, commitment, risk acceptance, work practices and risk and accident reduction. The results show that in all questions, workers with training showed a greater perception of safety and health at work compared to those workers without training.

Future research in this area could cover larger number of workers and other variables, which would increase the possibility of generalization of research results.

References

Ai Lin Teo, E., Yean Yng Ling, F., & Sern Yau Ong, D. (2005). Fostering safe work behavior in workers at construction sites. Engineering, Construction and Architectural Management, 12(4), 410-422. doi:10.1108/09699980510608848

Amde, W. K., Marchal, B., Sanders, D., & Lehmann, U. (2019). Determinants of effective organisational capacity training: lessons from a training programme on health workforce development with participants from three African countries. BMC Public Health, 19(1), 1557. doi:10.1186/s12889-019-7883-x

Barling, J., Kelloway, E. K., & Iverson, R. D. (2003). High-Quality Work, Job Satisfaction, and Occupational Injuries. Journal of Applied Psychology, 88(2), 276-283. doi:10.1037/0021-9010.88.2.276

Borger, J., Sun, Y., Bochmann, F., Guldner, K., Ponto, K., & Rose, B. (2011). Reduction of occupational injuries by conduction of a preventive training programme – an epidemiological follow-up study in the German glass industry. Occupational and Environmental Medicine, 68(Suppl_1), A25. doi:10.1136/oemed-2011-100382.77

Christian, M., Bradley-Geist, J., Wallace, C., & Burke, M. (2009). Workplace Safety: A Meta- Analysis of the Roles of Person and Situation Factors. The Journal of applied psychology, 94, 1103-1127. doi:10.1037/a0016172

Dodoo, J., & Al-Samarraie, H. (2019). Factors leading to unsafe behavior in the twenty first century workplace: a review. Management Review Quarterly. doi:10.1007/s11301-019-00157-6

Edwards, D., & Holt, G. (2008). Construction workers' health and safety knowledge. Journal of Engineering, Design and Technology, 6(1), 65-80. doi:10.1108/17260530810863343

Evanoff, B., Dale, A. M., Zeringue, A., Fuchs, M., Gaal, J., Lipscomb, H. J., & Kaskutas, V. (2016). Results of a fall prevention educational intervention for residential construction. Safety Science, 89(C), 301-307. doi:10.1016/j.ssci.2016.06.019

Floyde, A., Lawson, G., Shalloe, S., Eastgate, R., & D'cruz, M. (2013). The design and implementation of knowledge management systems and e-learning for improved occupational health and safety in small to medium sized enterprises. Safety Science, 60(C), 69-76. doi:10.1016/j.ssci.2013.06.012

Guo, B. H. W., Yiu, T. W., & Gonzalez, V. A. (2016). Predicting safety behavior in the construction industry: Development and test of an integrative model. Safety Science, 84, 1-11. doi:10.1016/j.ssci.2015.11.020

Gjorgjev, M., & Byanov, I. (2022). Impact of Investments in Healthy and Safe Working Conditions on Increasing Productivity and Effectiveness of Light and Heavy Industry Enterprises in the Republic of North Macedonia Compared to the Republic of Germany. Великотърновски университет „Св. св. Кирил и Методий".

Gjorgjev, M. (2023). State and Impact of Investments from the Application of Safety Measures at Work in Large and Medium-Sized Enterprises in the Republic of North Macedonia. St. Cyril and St. Methodius University of Veliko Tarnovo. https://doi.org/10.54664/ZFRL1371

Leiter, M. P., Zanaletti, W., & Argentero, P. (2009). Occupational risk perception, safety training, and injury prevention: testing a model in the Italian printing industry. J Occup Health Psychol, 14(1), 1-10. doi:10.1037/1076-8998.14.1.1

Mustard, L. R. a. C. (2019). Evaluation of the Implementation and Effectiveness of the Ontario Working at Heights Training Standard: Final Report. Retrieved from Toronto

Nkomo, H., Niranjan, I., & Reddy, P. (2018). Effectiveness of Health and Safety Training in Reducing Occupational Injuries Among Harvesting Forestry Contractors in KwaZulu- Natal. Workplace Health & Safety, 66(10), 508-508. doi:10.1177/2165079918774367

Ricci, F., Chiesi, A., Bisio, C., Panari, C., & Pelosi, A. (2016). Effectiveness of Occupational Health and Safety Training: A Systematic Review with Meta-Analysis. Journal of Workplace Learning, 28(6), 355. doi:10.1108/JWL-11-2015-0087

Slatin, C. (1995). Health and Safety training: Listening to your workers voice. NEW SOLUTIONS: A Journal of environmental and Occupational Health, 5, 4-5

Sokas, R. K., Emile, J., Nickels, L., Gao, W., & Gittleman, J. L. (2009). An intervention effectiveness study of hazard awareness training in the construction building trades. Public health reports (Washington, D.C. :1974), 124 Suppl 1(Suppl 1), 160-168. Retrieved from https://pubmed.ncbi.nlm.nih.gov/19618818

Taylor, E. L. (2015). Safety benefits of mandatory OSHA 10h training. Safety Science, 77, 66- 71. doi:10.1016/j.ssci.2015.03.003

Vignoli, M., Punnett, L., & Depolo, M. (2014). How to measure safety training effectiveness? Towards a more reliable model to overcome evaluation issues in safety training. Chemical Engineering Transactions, 36, 67-72. doi:10.3303/CET1436012