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The Influence of Occupational Health and Safety (OHS) Training and Education on the Safety Awareness of Infrastructure Construction Workers in Muna Regency

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ABSTRACT

The high rate of occupational accidents in the construction sector is often attributed to low worker safety awareness. In regions like Muna Regency, where infrastructure development is intensifying, enhancing safety awareness through systematic Occupational Health and Safety (OHS) education and training is critical. However, empirical evidence on the effectiveness of such training in this specific regional context remains limited. This study aims to analyze the effect of OHS education and training on the safety awareness of infrastructure construction workers in Muna Regency. This research employed a quantitative approach with a survey method. Data were collected through structured questionnaires distributed to 100 construction workers selected via purposive sampling. The instruments measured variables related to OHS training and safety awareness using a Likert scale. Data analysis involved validity and reliability tests, followed by simple linear regression analysis using SPSS. The findings indicate that OHS education and training have a positive and significant effect on workers' safety awareness. The regression analysis resulted in a coefficient of determination (R^2) of 0.42, meaning that 42% of the variance in safety awareness is explained by the training variable. The significance value was less than 0.05, confirming the statistical significance of this relationship. This study concludes that systematic OHS education and training are crucial factors in improving the safety awareness of construction workers in Muna Regency. These results highlight the need for contractors and local government agencies to prioritize and institutionalize continuous, high-quality OHS training programs to foster a stronger safety culture within the regional construction industry.

INTRODUCTION

The construction industry is globally recognized as one of the most hazardous sectors, contributing disproportionately to occupational accidents and fatalities (International Labor Organization, 2022). These incidents not only result in human suffering but also generate substantial economic losses through project delays, increased insurance premiums, and compensation claims. A major underlying cause of these accidents is the low level of safety awareness among construction workers, which often manifests in unsafe behaviors and non-compliance with Occupational Health and Safety (OHS) procedures (Choudhry & Fang, 2018; Hinze et al., 2023). This issue is particularly pronounced in developing countries, where rapid

infrastructure expansion is frequently not accompanied by equivalent improvements in safety management systems.

In Indonesia, the acceleration of national and regional infrastructure development has intensified construction activities across both urban and non-urban areas. Regions such as Muna Regency have experienced a surge in road, public facility, and small-to-medium-scale infrastructure projects as part of regional economic development initiatives. While these projects play a crucial role in improving connectivity and local economic growth, they also increase occupational risk exposure for construction workers, many of whom possess limited formal education, minimal safety training experience, and informal employment status (Sutrisna & Wibowo, 2023; Pratama et al., 2024). These workforce characteristics create unique safety challenges that differ substantially from those observed in large metropolitan construction projects.

Structured OHS education and training are widely recognized as essential interventions for improving safety performance in the construction sector. Empirical evidence indicates that effective training programs enhance workers' hazard recognition abilities, strengthen positive safety attitudes, and encourage compliance with safety procedures, including the proper use of personal protective equipment (PPE) (Lingard & Rowlinson, 2017; Guo et al., 2020; Li et al., 2022). More recent studies further emphasize that context-sensitive training tailored to workers' educational background and project scale has a stronger impact on safety awareness and behavioral change than standardized training models (Zhou et al., 2023; Rahman et al., 2024).

However, despite the growing body of literature on OHS training effectiveness, most existing studies focus on large-scale construction projects in urban or industrialized settings. Research examining the impact of OHS education and training in regional or rural infrastructure projects, particularly in Southeast Asian contexts, remains limited (Zhang et al., 2021; Nguyen & Le, 2023). In Indonesia, empirical studies tend to emphasize compliance audits or accident statistics at the organizational level, rather than quantitatively assessing how OHS training influences individual workers' safety awareness, especially in regions with limited supervision and fragmented safety governance .

Accordingly, a clear research gap exists regarding how structured OHS education and training affect safety awareness among construction workers involved in regional development projects. This study addresses this gap by quantitatively analyzing the relationship between OHS education and training and safety awareness among construction workers in Muna Regency. The novelty of this research lies in its focus on small-to-medium-scale regional infrastructure projects, its examination of a locally recruited workforce with diverse educational backgrounds, and its empirical contribution from a non-metropolitan Indonesian context. By doing so, this study provides evidence-based insights into how OHS training functions in environments where formal safety systems and regulatory oversight are often limited (Manajemen et al., 2022).

This paper is structured as follows. The Method section describes the research design, sampling technique, and data analysis procedures. The Results section presents the statistical findings of the study. The Discussion section interprets the results in relation to previous studies and contextual conditions. Finally, the Conclusion summarizes the key findings and offers practical recommendations for policymakers, contractors, and local governments to strengthen OHS implementation in regional construction projects.

METHOD

This study employed a quantitative approach with an explanatory research design to analyze the effect of Occupational Health and Safety (OHS) education and training on construction workers' safety awareness. The research was conducted during the first quarter of 2024 in Muna Regency, Indonesia. Primary data were collected through a structured questionnaire administered directly to construction workers involved in ongoing infrastructure projects.

The study population consisted of construction workers employed on government and private infrastructure projects in Muna Regency. A purposive sampling technique was applied to ensure that respondents possessed relevant experience and exposure to OHS practices. The inclusion criteria were: (1) workers actively involved in construction activities at the project site, (2) a minimum of six months of work experience in construction projects, and (3) prior exposure to at least one form of OHS education or safety briefing. Workers who were temporarily assigned, administrative staff, or those unwilling to participate were excluded from the study. This sampling approach was considered appropriate to capture respondents who could meaningfully evaluate the impact of OHS education and training on their safety awareness.

The dependent variable in this study was workers' safety awareness, measured through indicators reflecting attention to workplace hazards, compliance with safety procedures, and personal responsibility for safe behavior. The independent variable was OHS education and training, operationalized through key dimensions including understanding of safety procedures, hazard identification techniques, proper use of personal protective equipment (PPE), and knowledge of emergency response protocols.

Several individual characteristics, namely age, education level, work experience, and type of work, were included as control variables to account for potential differences in safety awareness among workers. These variables were analyzed descriptively to contextualize respondent characteristics and to ensure that the observed relationship between OHS training and safety awareness was not influenced by extreme demographic imbalance.

Data analysis was conducted in several stages. Univariate analysis was first performed to describe the distribution, frequency, and central tendency of each variable. Subsequently, bivariate analysis using simple linear regression was applied to examine the relationship between OHS education and training and workers' safety awareness. Hypothesis testing was conducted using simple linear regression analysis to determine the direction, magnitude, and statistical significance of the influence of OHS education and training on safety awareness. The use of simple regression was considered appropriate, as the primary objective of the study was to assess the direct effect of a single independent variable on one dependent variable.

This study adhered to ethical research principles involving human participants. Before data collection, respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. Informed consent was obtained from all participants before administering the questionnaire. The data collected were used solely for academic research purposes, and respondents' identities were anonymized to ensure privacy and confidentiality.

RESULTS

A total of 100 construction workers participated in this study. The demographic characteristics of respondents are presented in Table 1. Most respondents were between 31 and 40 years of age (45%), followed by those aged over 40 years (30%). This age distribution indicates that the workforce is dominated by individuals in their productive and mature working years, which may positively influence their ability to internalize and apply safety-related knowledge.

In terms of work experience, half of the respondents (50%) had 5–10 years of experience, while 30% had more than 10 years of experience. This distribution suggests that the majority of workers possessed substantial exposure to construction site conditions and potential hazards. Such experience is often associated with higher situational awareness; however, without structured OHS training, experience alone may not necessarily translate into consistent safe behavior. Therefore, the demographic profile of respondents provides a relevant context for examining the role of formal OHS education and training in shaping safety awareness.

Table 1. Frequency Distribution of Sample Characteristics (N = 100)

Variable	Category	Frequency (f)	(%)
Age	20–30 years	25	25.0
	31–40 years	45	45.0
	>40 years	30	30.0
Work Experience	<5 years	20	20.0
	5–10 years	50	50.0
	>10 years	30	30.0

Before hypothesis testing, the reliability of the research instrument was evaluated using Cronbach's Alpha. The OHS Education and Training variable demonstrated a Cronbach's Alpha value of 0.89, while the Workers' Safety Awareness variable achieved a value of 0.91. Both values exceed the recommended threshold of 0.70, indicating high internal consistency and confirming that the measurement items were reliable for further statistical analysis.

To test the primary hypothesis, a simple linear regression analysis was conducted to examine the effect of OHS education and training on workers' safety awareness. The results indicate a statistically significant positive relationship between the two variables. The coefficient of determination (R^2) was 0.42, suggesting that 42% of the variance in workers' safety awareness can be explained by OHS education and training. The overall regression model was statistically significant, as indicated by an F-value of 71.25 ($p<0.001$). The regression coefficients are presented in Table 2.

Table 2. Simple Linear Regression Analysis Results

Variable	B	Std. Error	t	p-value
(Constant)	12.45	2.11	5.90	<0.001
OHS Training	0.78	0.09	8.65	<0.001

Dependent Variable: Workers' Safety Awareness; R^2= 0.42

The regression coefficient for OHS education and training (β= 0.78) is positive and statistically significant ($p<0.001$), indicating that an increase in OHS training is associated with a corresponding increase in workers' safety awareness. This finding confirms that structured safety education plays a substantial role in shaping workers' cognitive and behavioral readiness toward safe work practices. The positive linear relationship between the variables is also visually supported by the upward trend observed in the scatter plot (Figure 1).

Multiple Regression Analysis

To obtain a more comprehensive understanding of the determinants of workers' safety awareness, a multiple linear regression analysis was conducted by incorporating additional predictors, namely age and work experience, alongside OHS education and training. The inclusion of these variables aimed to assess whether demographic factors contribute independently to safety awareness beyond formal training.

The multiple regression model showed an improved coefficient of determination (R^2= 0.48), indicating that 48% of the variance in safety awareness could be explained jointly by OHS training, age, and work experience. OHS education and training remained the strongest predictor (β= 0.62, $p<0.001$), while work experience demonstrated a modest but statistically significant effect (β = 0.21, $p<0.05$). Age, however, did not show a statistically significant influence on safety awareness ($p>0.05$).

These results suggest that while experience contributes to safety awareness, formal OHS education and training play a more dominant and consistent role. Experience without structured training may increase familiarity with hazards, but it is systematic safety education that effectively reinforces safe attitudes and behaviors among construction workers.

DISCUSSION

This study provides empirical evidence that Occupational Health and Safety (OHS) education and training exert a significant positive influence on the safety awareness of construction workers in Muna Regency. The finding that OHS training explains 42% of the variance in safety awareness ($R^2 = 0.42$) underscores its critical role as a primary determinant of safety-related cognition and behavior in regional infrastructure projects. This level of explanatory power can be considered relatively high when compared to similar studies in the construction safety literature, where training-related variables typically account for between 25% and 40% of variance in safety awareness or safety behavior (Lingard & Rowlinson, 2017; Zhang et al., 2021; Zhou et al., 2023). The relatively stronger effect observed in this study may be attributed to the limited exposure of workers in regional areas to systematic OHS training, thereby amplifying the perceived value and impact of such interventions.

The positive and statistically significant regression coefficient ($\beta = 0.78$, $p<0.001$) indicates that improvements in the quality and comprehensiveness of OHS education and training are directly associated with higher levels of safety awareness. This finding is consistent with the Theory of Planned Behavior (Ajzen, 1991), which posits that knowledge acquisition and skill development serve as fundamental antecedents to shaping attitudes and behavioral intentions. In the context of construction work in Muna Regency, structured training enhances workers' ability to recognize hazards, understand risk consequences, and internalize safe work procedures, thereby strengthening cognitive and attitudinal dimensions of safety awareness.

The robustness of the training–awareness relationship observed in this study aligns with prior research conducted in large-scale and urban construction settings. For example, Lingard and Rowlinson (2017) reported that safety training significantly improved risk perception and compliance among workers on major construction projects. However, the present study extends these findings by demonstrating that the effectiveness of OHS training persists in a regional development context where formal safety management systems, supervisory intensity, and regulatory enforcement may be comparatively limited. This highlights the contextual novelty of the study and suggests that OHS training serves as a foundational safety mechanism regardless of project scale or geographic location.

The demographic characteristics of the respondents further help explain the observed outcomes. A substantial proportion of the sample consisted of experienced workers, with 50% reporting 5–10 years of work experience. Experienced workers may possess tacit knowledge of site-specific hazards, enabling them to better contextualize and apply the content of OHS training. Nevertheless, the multiple regression results indicate that while work experience contributes modestly to safety awareness, OHS education and training remain the dominant predictor. This finding reinforces the argument that experience alone is insufficient to ensure high safety awareness without structured and systematic training.

Despite the strong explanatory power of the model, 58% of the variance in safety awareness remains unexplained by OHS training alone. This finding reflects the multifaceted nature of safety awareness in construction settings. Factors such as safety leadership, supervisory enforcement, peer influence, organizational safety climate, and availability of safety resources are likely to play significant roles. The absence of these variables in the current model suggests that safety awareness is shaped by an interaction between individual, organizational, and contextual factors.

Several limitations of this study should be acknowledged. First, the sample size was relatively modest and limited to a single regency, which may constrain the generalizability of the findings to other regions or larger construction projects. Second, the use of self-reported questionnaire data introduces the possibility of social desirability and response bias, potentially leading respondents to overestimate their safety awareness. Third, the cross-sectional design restricts the ability to infer causal relationships over time.

Future research should address these limitations by employing larger and more diverse samples across multiple regions to enhance external validity. Longitudinal research designs would be particularly valuable in examining how safety awareness evolves before and after OHS training interventions. Additionally, mixed-method approaches that combine quantitative analysis with qualitative interviews or observations could provide deeper insights into how training is perceived and implemented at the site level. Incorporating organizational variables such as safety leadership, safety culture, and supervisory practices would also contribute to a more comprehensive understanding of safety awareness determinants in regional construction contexts.

CONCLUSION

This study contributes to the construction safety literature by demonstrating that Occupational Health and Safety (OHS) education and training function as a central mechanism for shaping workers' safety awareness in regional infrastructure development contexts. Beyond confirming the general effectiveness of OHS training, this research extends existing knowledge by providing empirical evidence from a non-metropolitan setting, where formal safety systems, regulatory oversight, and institutionalized training practices are often less established than in large urban projects.

From a theoretical perspective, the findings reinforce behavior-based safety frameworks by showing that structured training remains a dominant determinant of safety awareness even when workforce experience levels are relatively high. This suggests that experiential learning alone is insufficient to sustain safety consciousness without formalized educational reinforcement. The study thus supports the argument that safety awareness is primarily constructed through intentional knowledge transfer and procedural standardization rather than through experience-based adaptation alone.

Practically, this study offers important insights for the design of OHS programs in regional construction projects. The results highlight the need for training models that are context-specific, continuous, and aligned with the risk profiles of small- to medium-scale infrastructure projects. For contractors and project managers, OHS training should be positioned not merely as a compliance requirement but as a strategic investment in workforce safety and project sustainability. For local governments, the findings support the integration of mandatory OHS training standards into project licensing and monitoring mechanisms, thereby strengthening safety governance at the regional level.

In terms of policy relevance, this study underscores the importance of decentralizing OHS capacity-building efforts to ensure that regional development initiatives are supported by effective safety interventions. By focusing on a locally recruited workforce in Muna Regency, this research provides contextualized evidence-based information that can inform regionally tailored OHS policies and training frameworks. Overall, the study offers a novel contribution by bridging the gap between national OHS policy objectives and the practical realities of safety implementation in regional construction environments.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

CK: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing - Original Draft Preparation, Project Administration.
MSR: Conceptualization, Resources, Validation, Writing - Review & Editing, Supervision.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to confidentiality agreements with participants, but are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that there are no competing interests, whether financial or non-financial, that could have influenced the work reported in this paper.

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