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Sustainable OSH Training for Safety Culture in the Construction Industry: The Case of Izmir Province[1]

Sinan VURAL[2] Orkun DALYAN[3] Ömer Faruk ÖZTÜRK[4] Mehmet PİŞKİN[5]

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Abstract
Sustainable occupational health and safety training (OHS) aims to minimize workplace risks and foster a strong safety culture through continuous, holistic learning. This study presents a pilot investigation into the relationship between safety culture and OHS practices among technical personnel in the construction sector. Specifically, it introduces and validates a newly developed Safety Culture Assessment Scale (SCAS) tailored to the Turkish construction context.
A face-to-face survey was conducted with 200 technical personnel employed across 20 residential construction projects in Izmir, Turkey. The SCAS underwent exploratory and confirmatory factor analyses to establish its structural validity, and internal consistency was assessed using Cronbach's alpha. Further, criterion-related validity was examined through statistical analyses, including Pearson correlation, Independent Samples t-tests, and one-way ANOVA.
Findings revealed significant relationships between demographic variables and the five core dimensions of safety culture. Strong positive correlations were found between management commitment, OHS training and communication, worker participation and awareness, and OHS reporting ($r = 0.581–0.718$, all $p < 0.001$). These results highlight the critical role of sustainable and targeted OHS training in enhancing safety awareness, improving risk perception, and cultivating a proactive safety culture within the construction industry.

Keywords: construction industry, safety culture, sustainable OHS training, technical personnel, Izmir

INTRODUCTION

Occupational Health and Safety (OHS) is a critical concern in high-risk sectors such as construction, where safeguarding workers' physical and psychological well-being is both a legal obligation and a moral imperative (Jaafar et al., 2017; Thompson & Doran, 2024). Among the many components that influence workplace safety, the concept of safety culture has emerged as a pivotal factor in shaping safety-related behaviors, perceptions, and compliance at both individual and organizational levels (Berglund et al., 2023). Safety culture is commonly defined as the shared values, beliefs, norms, and practices concerning safety, which play a fundamental role in identifying hazards, assessing risks, and implementing effective control measures (Cooper, 1998).

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** Corresponding author

[2]MSc, Çanakkale Onsekiz Mart University, Occupational Health and Safety Department, Çanakkale-Turkey, sinanvural7@gmail.com, orcid.org/0009-0008-4395-269X

[3]Ph.D. Student, Çanakkale Onsekiz Mart University, Occupational Health and Safety Department, Çanakkale-Turkey, orkundalyan@outlook.com, orcid.org/0000-0003-4791-9084

[4]Professor Dr., Çanakkale Onsekiz Mart University, Department of Chemical, Çanakkale-Turkey, ofozturk@comu.edu.tr, orcid.org/0000-0002-9244-6805

[5]Associate Professor Dr., Çanakkale Onsekiz Mart University, Food Processing Department, Çanakkale-Turkey, mehmetpiskin@comu.edu.tr, orcid.org/0000-0002-4572-4905

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A strong safety culture not only reduces the incidence of occupational accidents and diseases but also enhances employee satisfaction, trust, and organizational productivity (Shaikh et al., 2020). Therefore, promoting a positive safety culture is not merely a technical requirement but a comprehensive strategy that should extend beyond workplace boundaries into broader social consciousness. Empirical studies suggest that structured safety training and participatory engagement are crucial mechanisms for developing and sustaining a safety culture (Bautista-Bernal et al., 2024; Dalyan et al., 2021–2023; Laukkanen, 1999).

Importantly, safety culture is closely linked to behavioral risks in the workplace. Employees' perceptions of safety, their willingness to comply with regulations, and their trust in organizational safety practices influence not only the frequency of incidents but also the effectiveness of risk mitigation efforts (Lari, 2024; Lornudd et al., 2021). However, despite growing scholarly interest, there remains a limited understanding of how safety culture interacts with behavioral risks and worker well-being, especially in the construction industry, where decentralized structures, subcontracting, and variable risk exposures are prevalent (Choudhry et al., 2007; Lingard et al., 2012; Zhou et al., 2015).

Prior studies have highlighted the fragmented nature of construction work, particularly in developing countries, which often results in inconsistent implementation of safety protocols and increased behavioral risks (Alkilani et al., 2013; Mohammadi et al., 2018). The transient workforce, reliance on subcontractors, and inadequate supervision further complicate the establishment of a consistent safety culture, making it difficult to ensure long-term worker well-being (Fang et al., 2015; Goh & Binte Sa'adon, 2015).

Moreover, empirical studies focusing on technical personnel, key actors in operational safety, are particularly scarce, despite their central role in implementing on-site safety measures and maintaining compliance (Guo et al., 2016; Zhang et al., 2015). While some research has explored their situational awareness and behavioral predictors (Hasanzadeh et al., 2017), the majority of OHS literature continues to prioritize managerial or organizational perspectives over the practical insights of frontline technical staff (Chi & Han, 2013; Hinze & Wilson, 2000).

This study aims to address these gaps by investigating the impact of safety culture on behavioral risks and worker well-being, based on survey data from 200 technical personnel employed across 20 residential construction projects in Turkey.

Drawing on a multidimensional framework, the study evaluates various dimensions of safety culture and assesses the interplay between training, risk perception, management commitment, and behavioral outcomes (Cooper, 1998; Neal et al., 2000; Zohar, 1980). The analysis is underpinned by a newly developed and context-specific Safety Culture Assessment Scale (SCAS), which offers a validated instrument tailored to the unique characteristics of the Turkish construction sector, where safety-related behaviors are often shaped by organizational and demographic factors (Choi et al., 2017; Curcuruto et al., 2019)

Prior research indicates that general safety climate tools often fail to capture sectoral and regional particularities (Fuller et al., 2021; Lingard, 2002), highlighting the necessity for localized scales such as the SCAS. In this regard, the scale was developed following a systematic instrument development process (DeVellis, 2016) and is aimed specifically at addressing the challenges encountered by technical personnel, who are frequently underrepresented despite their central role in operational safety (Planek et al., 2014). Moreover, by integrating multiple dimensions of safety culture, including training, communication, participation, and management commitment, the study provides a comprehensive framework to assess behavioral outcomes and well-being in high-risk environments (Christian et al., 2020).

Over the past two decades, OHS research in construction has grown rapidly, focusing on themes such as safety climate, training effectiveness, and organizational behavior (Bautista-Bernal et al., 2024; Choi & Carlson, 2014; Lingard, 2002). While existing tools like the Safety Attitudes Questionnaire and Safety Climate Questionnaire provide useful insights, they often lack regional specificity and fail to capture the complex sociocultural dynamics of developing countries

(Choudhry et al., 2007; Zohar, 2010). These limitations become more pronounced in the context of construction industries, where localized practices, informal labor structures, and variable regulatory enforcement complicate standardized assessments (Geldart et al., 2010; Lingard & Rowlinson, 2005). This underscores the need for localized, industry-specific measurement tools, particularly in the Turkish context, where construction remains a dominant economic sector characterized by inconsistent safety standards and limited integration of safety culture principles (Akbiyikli et al., 2019; Yorio et al., 2015).

Furthermore, while previous studies have examined how demographic factors such as age, gender, experience, and education influence safety behaviors (Han et al., 2019; Neal & Griffin, 2006), and others have analyzed individual- and group-level influences on safety behavior (Cheung & Zhang, 2020; Gao et al., 2016), few have integrated these variables within a holistic framework that assesses safety culture as a dynamic, multi-level construct (Zohar & Polachek, 2014; Choudhry et al., 2007). By incorporating such variables, this research contributes to a more nuanced understanding of how individual and organizational factors jointly shape safety outcomes.

In parallel with the global shift toward sustainable safety management, there has been a growing emphasis on embedding sustainability principles into OHS training and cultural transformation efforts (Goh & Binte Sa'adon, 2015; Reiman & Rollenhagen, 2014). In the construction sector characterized by rapid technological changes, subcontracting chains, and complex workflows, this transformation necessitates participatory, continuous, and context-sensitive safety strategies (Lingard & Rowlinson, 2005; Zou et al., 2007).

Despite regulatory advancements and the increasing use of formalized safety protocols, persistent unsafe behaviors and preventable incidents continue to occur, especially in decentralized and dynamic construction environments (Aksorn & Hadikusumo, 2008; Choudhry et al., 2009). These ongoing issues reveal the inherent limitations of traditional compliance-based safety models and highlight the need for more transformative and culture-driven approaches to occupational safety (Goh et al., 2017; Hinze et al., 2013; Mohamed, 2002). As such, there is a pressing need to move beyond surface-level interventions and to embed proactive, systemic safety mindsets at both organizational and individual levels (Toole, 2002). This study responds to these challenges by:
1. Introducing a validated, context-specific Safety Culture Assessment Scale (SCAS) for the Turkish construction sector,
2. Empirically examining the interrelationship between safety culture, behavioral risk, and worker well-being, and
3. Assessing the moderating effects of demographic and organizational factors on safety perceptions.

The unique contribution of this study lies in its dual focus on measurement innovation and empirical exploration. Unlike prior research that centers on managerial perspectives or generalized safety indicators (Choudhry et al., 2007; Lingard et al., 2010), this study captures the lived experiences of technical personnel, who are often closest to site-level risks but underrepresented in research (Haslam et al., 2005; Teo & Ling, 2006). The findings offer practical insights for designing targeted, sustainable safety interventions and hold relevance for policy-makers, safety trainers, and industry leaders seeking to embed proactive safety practices in high-risk environments (Hinze et al., 2013; Goh & Binte Sa'adon, 2015).

Purpose of the Research

The primary aim of this study is to investigate the relationship between safety culture dimensions and occupational health and safety (OHS) practices among technical personnel in the construction industry. Specifically, the study seeks to:

1. Develop and validate a context-specific Safety Culture Assessment Scale (SCAS) tailored to the Turkish construction sector, with a particular focus on residential projects in Izmir Province,

2. Examine the influence of demographic and organizational variables (e.g., age, education level, experience, firm size) on safety culture perceptions,
3. Explore the interconnections between key dimensions of safety culture, such as management commitment, training and communication, worker participation, and reporting behavior, and their impact on safety-related behaviors and risk perception.
4. Contribute to the development of sustainable and participatory OHS training strategies by identifying cultural and behavioral factors that enhance or hinder the effectiveness of workplace safety programs.

Through this multidimensional approach, the study aims to provide empirical evidence and practical insights that inform the design of context-sensitive, sustainable safety interventions in the construction industry, particularly in developing country contexts where safety practices often remain fragmented and inconsistent.

METHOD

Type of Research

This study was conducted within the framework of a descriptive model using a cross-sectional research design in the quantitative research type. Cross-sectional studies aim to analyze the current situation by collecting data in a specific period (Rindfleisch et al., 2008). Therefore, the findings of the study are limited only to the sample group participating in the research and cannot be directly generalized to a wider population.

Population and Sample Selection

The study population comprises personnel actively involved in twenty specific housing construction projects located in Izmir, Turkey. To create the sample, the researcher employed the purposive sampling method, allowing for the selection of individuals directly pertinent to the research topic, following the approach proposed by Tongco Maria Dolores (2007).

To more accurately assess the perception of safety culture among technical personnel in the construction industry, it was aimed to select individuals with experience in this regard. The data of seven individuals with missing information were excluded from the analysis, resulting in a final study group of two hundred personnel.

Data Collection Tools

The SCAS used in this study was developed based on the eight-stage framework proposed by DeVellis (2016), ensuring methodological rigor and theoretical grounding. The SCAS comprises five main sections:

Section 1: Demographic information (gender, age, marital status, education level, total working hours, and monthly income).

Section 2: Institutional and work-related background.

Section 3: Shift systems and income characteristics.

Section 4: OHS systems implemented at the workplace.

Section 5: Safety culture perceptions measured using 57 items on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Before full-scale data collection, a pilot study with 10 technical personnel was conducted to assess the clarity and practicality of the items. Based on their feedback, several items were revised or removed. The final version of the scale was administered to 200 technical staff working in 20 residential construction projects across Turkey via face-to-face interviews conducted during working hours. Each session lasted 20–25 minutes, and data collectors were trained in OHS and

survey protocols. Participants were informed about the study's purpose, assured of confidentiality, and signed written informed consent. No incentives were provided.

Scale Development Process

The scale development followed these eight steps:

Definition of the Construct:

The construction of safety culture was conceptualized based on literature in occupational safety, drawing from Cooper (1998), Zohar (1980), and Neal et al. (2000), emphasizing dimensions such as training, participation, communication, management commitment, and fatalism.

Item Generation:

An initial pool of 75 items was developed to reflect these dimensions.

Response Format Selection:

A 5-point Likert-type scale (1 = Strongly Disagree to 5 = Strongly Agree) was used.

Expert Review for Content Validity:

Five experts in OHS and psychometrics reviewed the items for relevance, clarity, and redundancy. Twelve items were removed, and six were revised accordingly.

Pilot Testing:

Conducted with 10 technical staff, resulting in the removal of or rewarding of six additional items, leading to a final total of 57 items.

Main Administration:

The revised SCAS was administered to the main study sample (n = 200).

Exploratory and Confirmatory Factor Analyses (EFA):

EFA was conducted to explore the factor structure, followed by Confirmatory Factor Analysis (CFA) to confirm construct validity. A five-factor solution emerged, consistent with theoretical expectations.

Reliability Testing:

Cronbach's alpha coefficients for each subscale ranged from 0.78 to 0.91, indicating strong internal consistency.

Full scale is available in Appendix 1.

Data Processing and Analysis

Data collected from two hundred participants were subjected to statistical analysis using IBM SPSS version 24.0. Cronbach's alpha (α) coefficient was calculated to evaluate the internal consistency of the scale. The validity of the scale was examined with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Kolmogorov-Smirnov and Shapiro-Wilk tests were used to evaluate whether the normality assumption was met, and analysis groups were created according to these criteria (Tabachnick & Fidell, 2019). An independent sample t-test was applied for variables with two subgroups, while a one-way analysis of variance (ANOVA) was performed for variables with more than two groups (Hair et al., 2019). Cohen's d and eta-squared coefficients were calculated to determine the effect size of significant differences (Fritz et al., 2013).

EFA was used to determine the sub-dimensions that constitute the safety culture, and then the validity of the model was tested with CFA. Pearson correlation analysis was applied to examine the relationships between the variables, and the relationships between the factors were evaluated.

RESULTS

The frequency (f) and percentages (%) of the personal characteristics of the participants are given in Table 1.

Table 1 Frequency and Percentages of Descriptive Characteristics of Employees

Variable	Group	f	%
Age	15-20	0	0.0
	21-25	5	2.5
	26-30	21	10.5
	31-35	30	15.0
	36-40	28	14.0
	41-45	26	13.0
	46-50	28	14.0
	51-55	31	15.5
	56-60	7	3.5
	Over 60	24	12.0
	Total	**200**	**100**
Gender	Female	157	78.5
	Male	43	21.5
	Total	**200**	**100**
Marital status	Married	139	69.5
	Single	42	21.0
	Divorced/Widowed	19	9.5
	Total	**200**	**100**
Educational level	Primary school	63	31.5
	High school	86	43.0
	Associate degree	8	4.0
	Bachelor's degree	32	16.0
	Postgraduate	6	3.0
	None	5	2.5
	Total	**200**	**100**

Note. Percentages may not total exactly 100 due to rounding.

As shown in Table 1, the demographic characteristics of the participants are as follows: females constitute 78.5% of the sample, while males account for 21.5%. Age distribution is categorized into distinct ranges, with the highest proportions observed in the 31–35 years group (15%) and the 51–55 years group (15.5%). No participants fall within the 15–20 years age group.

Marital status data indicate that the majority of participants (69.5%) are married, followed by single individuals (21%) and those who are divorced or widowed (9.5%). Educational backgrounds vary, with high school graduates forming the largest group at 43%, followed by primary school graduates at 31.5%. In terms of higher education, 16% hold a bachelor's degree, 4% have an associate degree, and 3% possess a postgraduate degree. Additionally, 2.5% of participants reported having no formal education. The gender distribution shows that 78.5% of participants are female, while 21.5% are male. Statistical data of SCAS are presented in Table 2.

Table 2 The Safety Culture Assessment Scale Statistical Data

Data	α	Item	KMO	Sig.
Results	0.871	57	0.785	0.000

Note. KMO > 0.70 indicates sampling adequacy; $p < .001$ for Bartlett's Test confirms the factorability of the correlation matrix

According to Table 2, the reliability coefficient (Cronbach's alpha) of the scale was calculated as $\alpha = 0.871$. The Kaiser-Meyer-Olkin (KMO) value was 0.785. The significance level of Bartlett's test was 0.000 ($p < 0.05$). The statistical values related to the SCAS factors are presented in Table 3.

Table 3 Statistics of Safety Culture Assessment Scale factors

Code	Number of Items	α	Eigenvalue	Variance (%)
F-1	13	0.760	10.442	36.319
F-2	12	0.745	2.732	8.794
F-3	15	0.755	1.966	6.450
F-4	6	0.766	1.824	6.200
F-5	11	0.792	1.791	6.143

Note. α = Cronbach's alpha; values indicate internal consistency of each factor.

The outcomes of the factor analysis applied to the survey items are presented in Table 3. Five distinct factors (F-1 to F-5) were identified.

Factor 1, "Management Commitment," includes 13 items (α = 0.760) with an eigenvalue of 10.442, accounting for 36.319% of the total variance.

Factor 2, "OHS Training and Communication," consists of 12 items (α = 0.745), with an eigenvalue of 2.732, explaining 8.794% of the total variance.

Factor 3, "Employee Participation and Awareness," includes 15 items (α = 0.755), with an eigenvalue of 1.966 and variance contribution of 6.450%.

Factor 4, "Fatalism," contains 6 items (α = 0.766), eigenvalue = 1.824, variance = 6.200%.

Factor 5, "OHS Reporting," includes 11 items (α = 0.792), eigenvalue = 1.791, variance = 6.143%.

The five-factor structure explains a total of 63.91% of the variance (Fritz et al., 2013). The results of the independent samples t-test conducted between Factor 2 (OHS Training and Communication) and gender are shown in Table 4.

Table 4 Independent Samples t-Test Results Between F-2 Factor and Gender Variable

Gender	M ($\bar{X}$)	SD	SE	t	p	d
Female	3.09	0.55	0.04	4.37	0.00*	0.86
Male	3.77	0.97	0.14			

Note. M = Mean; SD = Standard deviation; SE = Standard error of the mean; d = Cohen's d effect size.
*Significant at the p < .05 level.

Table 4 displays the outcomes of a t-test carried out to contrast the mean scores of an F-2 factor variable between two groups, classified by gender (female and male). The analysis outcomes reveal a statistically significant difference in the OHS Training and Communication factor mean scores between male and female participants (t = 4.371, p < 0.05). Based on the effect size coefficient (0.86), the gender variable demonstrates a substantial impact on the OHS Training and Communication factor, with a large effect size. The mean score for male participants in the OHS Training and Communication (F-2) factor was higher than that of female participants. The results of the ANOVA conducted between the Employee Participation and Awareness factor, coded as F-3, and the educational level variable are presented in Table 5.

Table 5 ANOVA Results Between The F-3 Factor and The Educational Level Variable

Education Level	M ($\bar{X}$)	SD	F	p	η^2	Difference
1	3.06	0.37	27.48	0.00*	0.41	3,4,5>1,2
2	3.08	0.35				
3	3.97	0.55				
4	4.06	0.92				
5	4.10	0.46				
6	3.98	0.54				

Note. 1=Primary Education, 2=High school, 3=associate degree, 4=Bachelor's Degree, 5=Postgraduate, 6=None, η^2=Eta-squared (effect size) Significant differences were found at p < .05.
Post hoc comparison shows that groups 3 (associate), 4 (bachelor's), and 5 (postgraduate) scored significantly higher than groups 1 (primary) and 2 (high school).

Derived from the data outlined in Table 5, a noteworthy distinction emerges among the groups regarding the Employee Participation and Awareness factor and the educational level variable [F(5, 194) = 27.487, p < 0.05]. Post hoc multiple comparison tests disclose significant differences between groups with associate, bachelor's, and postgraduate degrees compared to those with primary and high school education. The effect size for the educational level variable is substantial. The results of ANOVA conducted between the Fatalism factor (coded as F-4) and the professional experience variable are presented in Table 6.

Table 6 One-Way ANOVA Results for Factor 4 Scores by Professional Experience

Experience Group	$\bar{X}$	SD	F	p	η^2	Difference
1 (≤1 year)	1.47	0.62				
2 (2–4 years)	2.08	0.52				
3 (5–9 years)	2.17	0.99	8.13	0.00*	0.17	5 > 1,2,3
4 (10–14 years)	2.76	0.84				
5 (15–19 years)	2.88	0.70				
6 (≥20 years)	2.56	0.73				

Note. $p < .05$ is considered statistically significant. **Difference** comparisons (Tukey HSD) indicate that Group 5 scored significantly higher than Groups 1, 2, and 3.

According to the outcomes outlined in Table 6, a statistically significant difference was observed among the groups concerning the Fatalism factor and the variable of professional experience [F(5, 194) = 8.133, p < 0.05]. The multiple comparison tests indicated that the 15–19 year group significantly differed from the 1 year and below, 2–4 year, and 5–9 year groups. The effect size analysis showed that the total working time variable had a substantial impact on the Fatalism factor. The results of the Pearson Correlation analysis among the SCAS factors are presented in Table 7.

Table 7 Correlation Analysis Results Between Safety Culture Assessment Scale Factors (n = 200)

Factor		F1	F-2	F-3	F-4	F-5
F-1	r	1	0.704	0.635	- 0.335	0.581
	p	-	0.000**	0.000**	0.000**	0.000**
F-2	r		1	0.718	- 0.426	0.643
	p		-	0.000**	0.000**	0.000**
F-3	r			1	- 0.567	0.628
	p			-	0.000**	0.000**
F-4	r				1	- 0.465
	p				-	0.000**
F-5	r					1
	p					-

Note. F-1 Management Commitment, **F-2** OHS Training and Communication, **F-3** Employee Participation and Awareness, **F-4** Fatalism, **F-5** OHS Reporting, **r**= Pearson Correlation coefficient (2-tailed), **=p<0.01 indicates statistically significant correlation.

According to Table 7, a strong positive correlation was observed between OHS training and communication (F-2) and management commitment (F-1) (r = 0.704, p < 0.01). Similarly, a significant positive correlation was found between employee participation and awareness (F-3) and OHS reporting (F-5) (r = 0.628, p < 0.01).

Conversely, the fatalism factor (F-4) demonstrated a moderate to strong negative correlation with all other SCAS dimensions, ranging from r = –0.335 to r = –0.567 (p < 0.01).

Overall, statistically significant positive correlations were observed among management commitment (F-1), training and communication (F-2), and employee participation and awareness (F-3) (p < 0.01), indicating a strong interrelationship among these factors.

CONCLUSION and DISCUSSION

The findings of this study support and extend previous research (Neal et al., 2000; Reason, 1997) by reaffirming that training, communication, and managerial commitment form the foundation for establishing a proactive safety culture. The significant positive correlation ($r = 0.704$, $p < 0.01$) between managerial commitment (F-1) and OSH training and communication (F-2) aligns with Neal et al.'s (2000) framework linking safety climate and individual behavior through organizational practices. Similarly, Reason (1997) emphasized that organizational failures often arise through inadequate training and communication; both are directly addressed in this study.

The correlations between F-1 (Managerial Commitment), F-2 (Training), and F-3 (Participation) provide empirical support for Zohar's (1980) conceptualization of safety climate as a shared perception of managerial commitment. The negative relationship between fatalism (F-4) and the other dimensions supports the findings of Wang et al. (2023), which indicate that disengagement from safety practices increases in environments with inadequate leadership support.

Education level and work experience emerged as significant predictors of participation and reporting behaviors. Respondents with higher education levels reported significantly greater engagement in safety-related participation and awareness (F-3), consistent with Cooper's (2000) model, which conceptualizes safety culture as a result of behavioral, situational, and cognitive factors. Post-analysis revealed statistically significant differences between participants with higher and lower education levels ($p < 0.05$, $\eta^2 = 0.41$). Similarly, those with less than one year of experience reported higher participation in F-2, F-3, and F-5, indicating increased motivation and risk awareness during the orientation phase (Yıldız and Yılmaz, 2017).

The strong positive correlation ($r = 0.718$, $p<0.01$) between F-2 (OHS Training and Communication) and F-3 (Participation and Awareness) highlights the dual function of training: a tool for disseminating information and a strategic tool for promoting a participatory safety culture (Cooper, 2000). Gender differences were also observed. Male employees reported higher scores on the training and participation factors, while female employees scored higher on fatalism. This is consistent with Demirbilek and Çakır (2008) and Han et al. (2019), who suggest that gender inequalities in training access and operational roles can influence perceptions and behaviors. These differences highlight the need for gender-sensitive safety interventions, particularly in male-dominated industries like construction.

Furthermore, participants with 15-19 years of experience exhibited higher fatalism, while those with over 20 years of experience demonstrated greater alignment with management commitment. These patterns may reflect how prolonged exposure to organizational norms influences safety attitudes, increasing trust in management processes or normalizing risk over time (Durgut, 2019).

Correlation analyses revealed strong positive correlations between F-1, F-2, F-3, and F-5 ($r = 0.581$ to 0.718, all $p < 0.001$), suggesting that improvements in training and communication not only increase participation but also reinforce trust in management and willingness to report hazards. Conversely, F-4 (Fatalism) showed moderate negative correlations with all other dimensions ($r = -0.335$ to -0.567). This suggests that fatalistic beliefs hinder the adoption of proactive safety practices, consistent with Reason's (1997) corporate accident model.

This study contributes to the literature by examining the relationships among the five dimensions of the Safety Culture Assessment Scale (SCAS) in a sample of 200 white-collar workers across twenty construction projects in Izmir, Turkey. The scale demonstrated strong internal consistency (Cronbach's $\alpha = 0.871$), and its factor structure was confirmed by adequate sampling (KMO = 0.785) and significant Bartlett test results ($p < 0.001$), supporting its robustness (Costello and Osborne, 2005; Taber, 2017).

More importantly, this study identifies context-specific dynamics in the Turkish construction industry. Hierarchical and demographic differences (especially education, gender, and experience) indicate that safety culture development is not uniform. Therefore, industry-specific

safety programs should be tailored to address these differences. Employees with lower levels of education tend to align with corporate leadership, while those with higher levels contribute through increased procedural participation. These complementary roles confirm the need for integrated training strategies that empower all employee groups.

The findings are consistent with previous research conducted in diverse cultural settings (Lingard, 2002; Liao et al., 2017; Vinodkumar and Bhasi, 2010; Choi and Carlson, 2014; Acheampong et al., 2024) and highlight the importance of educational background in promoting safety participation. Structured and ongoing training aligned with cognitive, behavioral, and organizational dimensions is vital for building resilient safety cultures.

However, limitations remain. Psychosocial risk management has not been fully integrated into the current security assessment framework. Future research should explore sustainable, behavior-based training models that include mental health support and stress management to enhance long-term employee well-being and organizational resilience.

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Appendices

Appendix 1. Safety Culture Assessment Scale

Gender	Female		Male			
Marital Status	Married		Single		Divorced/Widowed	
Age	18-20 age		21-25 age		26-30 age	
	31-35 age		36-40 age		41-45 age	
	46-50 age		51-55 age		56-60 age	
	Over 60 years					
Educational Level	Primary School		High School		Associate's Degree	
	Bachelor's Degree		Postgraduate		None	
Professional Experience	1 year and below		2-4 years		5-9 years	
	10-14 years		15-19 years		20 years and over	

5-point Likert scale:
1=Fully Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Fully Agree

Statements	1	2	3	4	5
1. Management promptly takes action to address management and occupational safety issues in my workplace.					
2. When an occupational safety concern arises, management acts resolutely.					
3. Whenever management discusses unsafe practices, corrective measures are always taken.					
4. Managers in my workplace show interest in my safety.					
5. We are constantly reminded by management and section supervisors to comply with the instructions on safety warning signs.					
6. If occupational safety procedures are not fully established in my workplace/department, managers and auditors express their concerns.					
7. It ensures the immediate elimination of any element that may pose a risk of occupational accidents, even if it is costly.					
8. A significant amount of time and money is allocated for the education of employees on occupational health and safety.					
9. Employees can share their workplace health and safety concerns with management.					
10. The workplace physician and occupational safety specialist are granted the necessary authority to perform their duties and inspections.					
11. Management clearly considers the importance of employee occupational safety.					
12. The operation of occupational safety procedures is carefully monitored.					
13. Management believes that occupational safety is as important as production.					
14. There is good communication among groups in this workplace.					
15. The scope of objectives and goals is clearly defined in this workplace.					
16. Employees can negotiate with top management on occupational safety issues.					
17. There is open communication about occupational safety issues in this workplace.					
18. Occupational safety topics are given high priority in workplace training programs.					
19. Workplace health and safety training covers many situations encountered by employees in their jobs.					
20. Employees receive detailed training on workplace health and safety.					
21. Employees have sufficient access to workplace health and safety programs.					
22. I believe that the cause of workplace accidents in this workplace is lack of training.					
23. Regular informative meetings on workplace health and safety are held by experts in this workplace.					
24. Those providing training have the necessary knowledge and experience in occupational health and safety.					
25. I believe that workplace health and safety training increases awareness of occupational safety.					
26. Employees participate in the preparation of regulations for procedures and usage instructions.					
27. Employees actively participate in the preparation, implementation, improvement, and monitoring of workplace health and safety plans, committees, and teams.					

28. Employees comply with safety regulations.					
29. Employees make written suggestions for deficiencies in working conditions and occupational safety issues.					
30. I use/implement the correct occupational safety procedures in my work.					
31. I ensure high levels of occupational safety while performing my job.					
32. I voluntarily carry out supportive tasks and activities to improve workplace safety.					
33. I am aware of my responsibilities for workplace safety.					
34. I know the necessary workplace safety rules for my job.					
35. I always comply with occupational safety rules.					
36. I am aware of the risks related to my field.					
37. I know which risks personal protective equipment is used against.					
38. I am aware of the costs and damages to workers, employers, and the state caused by occupational accidents and occupational diseases.					
39. I keep track of regulations, legislation, and other publications (books, articles, etc.) related to occupational health and safety in my field.					
40. Personally, occupational safety issues are not the most important aspect of my job.					
41. Accidents are inevitable.					
42. It is not possible to prevent accidents.					
43. The use of machines and technical equipment makes accidents inevitable.					
44. What will happen to you is largely a matter of luck while working.					
45. I have been doing this job for years, nothing will happen to me.					
46. Despite the company's efforts, preventing accidents seems inevitable.					
47. We always report accidents and hazardous incidents in the workplace.					
48. I am encouraged to report near-miss incidents.					
49. Incident/accident reports are used to improve occupational safety.					
50. Lessons are learned from near-miss and accident reports in our company.					
51. I am encouraged to report unsafe conditions in the workplace.					
52. Our workplace supervisors create monthly safety cards for us, evaluate them in meetings, and share them with us.					
53. They consult with us to develop health and safety measures.					
54. They teach us how to detect problems before health and safety measures are needed.					
55. Besides making requests, they explain to us why we need to work in a healthy and safe manner.					
56. I believe that even under pressure, we should follow the occupational safety rules.					
57. Although it may be uncomfortable, I believe that personal protective equipment should be used during work.					