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Need of Introducing Safety Curriculum in School Education Under Skill Development Scheme is Necessity for Future Generation

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Abstract

Workplace hazard associated in construction industry are more in compared to other due to first changing work environment. The construction industry is the 2nd highest employment category after agriculture sector in India. All Category of people in terms of education starting from highly qualified person to illiterate everyone gets an opportunity to work in the industry accordingly to their skill. The organizations working in the industry are in the process of implementing safety best practices into the system to uplift the safety culture.

In construction industry employees gets very short time to customize them with the environment and perform the work. On first days very beginning of work at site the employee must work with the situational hazards associated in the surrounding, either he has an awareness about the basic safety requirements of construction work or not. While working in the construction site employees do unsafe actions either knowingly or unknowingly: it is a matter of discussions. To understand the fact about the causes of unsafe work at project site, a survey was conducted among the construction workers at different project of various sectors by an in-depth interview process. The survey questionnaires were made based on the various aspects associated with socioeconomic factors of construction industry. Further the field data collected has been analysed to understand the reason of unsafe actions at worksite. This paper emphasis on one of the important aspects in the system that is employee's education. The efforts have been made to identify the implication of the education aspect in the work environment. Accordingly, the recommendations were made to bring improvement in system to improving employee's knowledge on safety by introducing safety education at primary school level.

Keywords: Employee's knowledge, hazard understanding, unsafe work, acceptance to the risk, situational hazards, socioeconomic factors, workplace hazard.

1. Introduction

Construction industry work is basically a hardship work and changes every day. The location and work environment are varying accordingly to the phase of the work progresses. People working in the industry are mix of their demographic data. Education wise mostly qualified people are working, but don't have knowledge of how work is to be performed safely. They take the risk in the higher side. Examples don't wear the protective equipment's while working the high-risk work. Due young age of employment they don't have previous experience of such dangerous situations. Work planning also plays a key role is executing the work in a time bound manner and safely. People even working senior most position don't wear basic PPE working at site. Most of the employees have idea about the PPE means Helmet and safety shoes. The other PPE like safety goggles and hand gloves are the less priority for the employees. But these two PPE protect the vital organ of the human body. If the hand is not protected by hand gloves, then employees while engaged in job get in contract with sharp edge and hazardous material. Similarly, use of safety goggles also a less important for the employees. Even the senior management people went to site without safety goggles. Safety goggles protect the most vistal organ of human body eye. If eye can be neglected, other vital part effects due to not using of PPE can be imagined. Which is reflected through a work place injury. The use PPE at work site is purely depends on the management commitment. If management is not committed then other employees working below to then will not follow the safety rules or procedures described for the work. The research says more the people get older the maturity in the mind comes automatically. Once the maturity come to mind people take care of the body and wellbeing. Since the younger people are more working in the construction industry. They don't have maturity and understanding

they always have mid set nothing is going to happen to them, they completed similar work in previous job. But every minute plays an important role, if the safety steps are bypassed then you are going a deliberate safety violation, which is an unsafe action.

In this paper the author has focused on the employee's educations how it reflects on the behaviour at job site. After observing the workers actions and behaviour at construction site, it understood that people are very casual while performing their work. The steps defined for the work to be followed are not being executed. Housekeeping is another issued where right thing at right place are not followed. Many tripping hazards existing at site, still people don't care to mitigate those. The risk appetite is more at all level of employees. People know many safety rules but when it comes using and implementation there the acceptance is come down. This may be due to carelessness or work pressure that need to be found out.

2. Methodology

Research methodology constitutes the systematic architecture underpinning the entire investigative process. It delineates the instruments, analytical techniques, and procedural strategies employed to collect, examine, and interpret empirical data in pursuit of resolving a defined research problem. Mastery of methodological principles is indispensable for executing research with scientific precision, internal consistency, and epistemological rigor.

In the context of examining the influence of factors on unsafe behaviour of employees at work site within the construction sector, the design of a rigorous methodology is paramount to securing reliable and valid data. The research must be strategically structured to support empirical generalization and theoretical contribution.

This chapter articulates the comprehensive research methodology adopted for the present study. It explicates the research design, delineates the data sources, and details the sampling framework, including target population identification, sampling techniques, and sample size justification.

This study adopts a quantitative method research design, strategically approaches to ensure a comprehensive exploration of systemic barriers contributing to unsafe work practices in the construction industry. The objective is two-fold: first, to identify and evaluate the latent and manifest factors that precipitate human error; and second, to formulate innovative, evidence-based recommendations that can mitigate these errors effectively.

The quantitative component is designed to capture the prevalence, frequency, and patterns of unsafe practices through structured surveys and analysis of safety performance records.

The rationale for this design lies in its capacity to triangulate findings, thereby enhancing the validity and interpretive depth of the study. The design enables the researcher to move beyond surface-level symptoms and interrogate the interlocking systemic failures that shapes unsafe behaviour, ranging from flawed task design and inadequate supervision to inconsistent policy enforcement and weak safety culture.

The methodological framework employed to delineate the target population, construct a robust sample design, and determine an appropriate sample size for the empirical investigation. Grounded in the overarching objective of identifying and evaluating systemic barriers contributing to unsafe work practices in the construction industry, the sampling strategy was meticulously crafted to ensure representativeness, relevance, and analytical rigor.

Primary data were generated directly from stakeholders embedded within construction environments. These data were indispensable for capturing first-hand accounts of risk-prone behaviours, organizational constraints, procedural lapses, and perceptual blind spots that contribute to human error. The empirical investigation of primary data followed a structured approach.

Structured questionnaires were administered to a wider respondent base, capturing quantitative data on key dimensions such as safety climate, communication flows, procedural adherence, and perceived risk tolerance. The instrument incorporated Likert-scale items and was pre-tested for reliability and content validity. All primary data were documented, transcribed, and analysed using statistical analysis (for survey responses). This triangulation enhanced the credibility, reliability, and empirical depth of the study, revealing both overt and latent factors underpinning unsafe practices.

The integration of multiple data sources was essential for addressing the research aim: to expose and evaluate the structural and human elements that coalesce into

unsafe work performance. Primary data captured the live realities and granular complexities of frontline workers, and documented risk patterns. By drawing from both empirical evidence and normative frameworks, the research mitigated the risk of epistemic blind spots and bolstered its capacity to generate innovative, context-sensitive recommendations for error reduction in the construction industry.

Data has been gathered with the help of structured questionnaires. Questionnaires have been prepared using 5-point Likert type scale where respondents are asked to share their opinions regarding various research questions under study. Questions have been carefully crafted so as to gather meaningful information with respect to identified research variables.

Demographic variables are specific characteristics of a population used in research, and policy-making to identify and understand different groups within a society. These variables are essential for analysing trends, predicting behaviours, and making informed decisions. Understanding these variables is crucial for businesses to target their efforts, for organizations to develop policies, and for researchers to analyse the phenomena. By segmenting populations based on these variables, more precise and effective strategies can be developed to meet the needs of different groups.

Table 1: Profile of Sample Respondents on Work Place.

Variable Name	Description	Code Allotted
Employee Category	Unskilled	1
	Semi-Skilled	2
	Skilled	3
	Supervisor or above	4
Department	Civil	1
	Mechanical	2
	Electrical	3
	Equipment Operator	4
	Scaffolder	5
Industry Sector	Oil & Gas	1
	Thermal Power	2
	Infrastructure & Real Estate	3
	Steel & Mines	4

Table 1 delineates the occupational stratification of the sampled workforce, offering a granular overview of their employment characteristics across three categorical variables: Employee Category, Department, and Industry Sector.

Employee Category: This variable is operationalized along a four-point ordinal scale, capturing ascending levels of skill and responsibility. The scoring rubric assigns a baseline value of 1 to Unskilled labour, escalating incrementally to a score of 4 for individuals occupying positions of Supervisor or Above. This gradation underscores a vertical mobility in the organizational hierarchy, thereby enabling the research to map correlations between skill level and workplace outcomes.

Department: This is the affiliation of respondents and is codified into five discrete categories, ranging from Civil (1) to Scaffolder (5). This classification allows for the disaggregation of occupational roles, which may yield nuanced insights into departmental cultures, inter-functional dynamics, and differentiated risk exposures.

Industry Sector: This represents the dimension demarcates the macro-contextual setting in which respondents are embedded. With coding spanning from Oil & Gas (1) to Steel & Mines (4), the framework situates the workforce within distinct industrial ecosystems. This typology serves as a critical lever to unpack sector-specific management practices, regulatory environments, and labour dynamics.

Taken together, these coded variables act as interpretive anchors that permit the researcher to "drill down" into the heterogeneity of the sample. By capturing structural nuances through numerically indexed categories, the table sets the stage for a more fine-grained, multivariate analysis that can unravel latent patterns within and across organizational and sectoral boundaries.

Table 2: Profile of Personal Information of Sample Respondents

Variable Name	Description	Code Allotted
Age	Young	1
	Middle Aged	2
	Senior	3
Gender	Male	1
	Female	2
Marital Status	Unmarried	1
	Married	2
Experience	Within 5 Years	1
	5-10 Years	2
	10-20 Years	3
	Above 20 Years	4
Education	Up to Higher Secondary	1
	Graduation	2
	PG or above	3

Table 2 delineates the demographic contours of the sample respondents, offering a categorical breakdown across five personal variables: age, gender, marital status, professional experience, and educational attainment. Each variable has been operationalized with a scoring rubric to facilitate subsequent statistical analysis.

Age: This was stratified into three cohorts: Young (assigned a score of 1), Middle-aged (2), and Senior (3). This segmentation enables an exploration of generational effects on managerial perceptions and decision-making patterns.

Gender: This was coded dichotomously, with Male respondents receiving a score of 1 and Female respondents a score of 2. While this binary classification simplifies data aggregation, it also calls attention to the need for more inclusive gender metrics in future research.

Marital Status: This was captured in binary terms: Unmarried (1) and Married (2). This variable serves as a proxy to examine how familial obligations may shape managerial priorities or professional mobility.

Experience: This was measured in four ascending brackets, reflecting tenure in professional settings: Within 5 years (1), 5–10 years (2), 10–20 years (3), and Above 20 years (4). Such granularity allows for a nuanced interpretation of how accumulated work exposure correlates with strategic orientation and leadership styles.

Educational Qualification: This was grouped into three tiers: Up to Higher Secondary (1), Graduation (2), and Postgraduate or above (3). This variable is pivotal in gauging the cognitive frameworks and theoretical grounding that respondents bring to organizational contexts.

Taken together, this structured classification lays the groundwork for cross-tabulation and inferential testing, thereby enabling the researcher to draw meaningful connections between personal attributes and managerial constructs. In sum, Table-4.3 does more than just paint a demographic picture rather it sets the stage for a deeper dive into how individual profiles may colour strategic behaviour in management settings.

In alignment with the analysis framework detailed earlier, this sub-section delineates the profile of variables employed to examine the social issues underlying unsafe work behaviours in the construction industry. These variables, carefully operationalized through validated scales and empirical constructs, capture the socio-cultural, organizational, and perceptual dimensions that influence individual and group-level safety outcomes.

A. Profile of Variables Used for Education Issues:

In alignment with the broader framework of instrument analysis within this research methodology, this sub-section delineates the profile of key variables integral to understanding education-related barriers affecting occupational safety performance in the construction industry. The selected variables namely Technical Knowledge, Limited Education, Literacy, Supervisor Qualification, and Safety Education capture distinct yet interconnected dimensions of the workforce's educational foundation and its influence on safety-related behaviour. Each variable has been operationalized based on empirical relevance and theoretical grounding to ensure construct validity. This profiling not only informs the structure of the data collection instrument but also strengthens the analytical lens through which the role of educational inadequacies in fostering human error is critically assessed.

Table 3: Questionnaire Analysis on Education Issues

Question Description	Focus Area	Response Code
Lack of technical safety training in the skill development centre, workers suffering with technical safety knowledge or skills to perform tasks safely.	Technical Knowledge	(1 - 5)
Workers with limited educational backgrounds find it difficult to understand safety instructions and signage.	Limited Education	(1 - 5)
Limited literacy of Workers may struggle to understand written safety procedures or instructions.	Literacy	(1 - 5)
Educational qualifications of site supervisors influence their ability to enforce safety standards effectively.	Supervisor Qualification	(1 - 5)
Inadequate inclusion of occupational safety topics in school curricula is a barrier to safe work behaviour in construction.	Safety Education	(1 - 5)

N.B:- *1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree*

Table 3 delineates respondent perspectives on critical educational impediments influencing occupational safety behaviour within construction environments. The questionnaire probed multiple facets, each coded on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), encompassing both technical and foundational educational shortcomings.

Technical Safety Training Deficiencies: Respondents underscored the dearth of structured technical safety training within skill development centres. The absence of such foundational instruction hampers workers' capacity to execute tasks within safe operational thresholds. This shortfall in institutional training constitutes a systemic gap that undercuts workforce preparedness and raises exposure to safety-related hazards.

Educational Background and Comprehension of Safety Protocols: Participants flagged the challenges faced by workers possessing limited educational attainment. These individuals struggle to decode safety instructions and misinterpret signage, a situation that may jeopardize compliance with critical safety procedures. The findings amplify concerns about cognitive accessibility and the need to tailor communication to varying literacy levels.

Literacy Constraints in Safety Communication: The data further illustrate that limited literacy acts as a stumbling block for workers in comprehending written safety protocols. This literacy gap stymies the transfer of safety knowledge and throttles effective procedural implementation, particularly in high-risk construction activities where clarity is paramount.

Supervisory Qualifications and Safety Enforcement: A notable correlation is suggested between the educational qualifications of site supervisors and their competence in enforcing safety norms. Inadequate academic backgrounds may erode supervisory authority and dilute the rigor of safety oversight. This undermines hierarchical accountability, a cornerstone of structured safety management systems.

Curricular Deficiencies in Safety Education: Respondents drew attention to the systemic exclusion of occupational safety content from formal educational curricula. This curricular vacuum cripple's early awareness and curtails the development of safety-conscious behaviour prior to workforce entry. Bridging this educational lacuna is imperative for cultivating a culture of safety at the grassroots level.

Hypotheses used in this Study:

H-Disregard for organizational and safety-related aspects tied to *educational support* significantly contributes to the prevalence of unsafe employee behaviour at the worksite.

3. Data Analysis

Through rigorous interpretation of field observations, survey responses, and expert interviews, this chapter seeks not only to expose the structural and procedural impediments for safe performance, but also to inform the formulation of practical, evidence-based interventions.

This section systematically interrogates the reliability of systems shaped by a spectrum of social, welfare, environmental, and institutional issues, each contributing, directly or indirectly, to the persistence of unsafe behaviours within construction environments. By critically evaluating factors such as inadequate training, fragmented communication, limited employee participation, and systemic oversight failures in monitoring and inspection, this analysis underscores how organizational blind spots and neglected human factors degrade system resilience. These variables are not isolated occurrences but interlocking barriers that distort risk perception, erode accountability, and normalize unsafe practices on-site. The goal is to foreground these latent conditions as core contributors to human error, thereby framing them as pivotal intervention points in the development of more adaptive, error-tolerant safety systems. Out of all the other socioeconomic factors taken in this research purposes here only education factor has been discussed in this paper.

Table 4: Reliability Analysis of Response Data Evaluating Organizational and Safety Related Education Issues.

Questions	Focus Area	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
Lack of technical safety training in the skill development centre, workers suffering with technical safety knowledge or skills to perform tasks safely.	Technical Knowledge	16.90	6.842	0.746
Workers with limited educational backgrounds find it difficult to understand safety instructions and signage.	Limited Education	17.99	5.405	0.777
Limited literacy of Workers may struggle to understand written safety procedures or instructions.	Literacy	17.11	5.824	0.788
Educational qualifications of site supervisors influence their ability to enforce safety standards effectively.	Supervisor Qualification	16.88	6.571	0.719
Inadequate inclusion of occupational safety topics in school curricula is a barrier to safe work behaviour in construction.	Safety Education	16.98	6.375	0.716

N.B:- *Cronbach Alpha for 379 cases of 5 items* = 0.795

The reliability analysis presented in Table 4 offers an empirical assessment of the internal consistency of five education-related constructs influencing safety performance within the construction industry. The overall Cronbach's Alpha ($\alpha = 0.795$) reflects a high degree of internal reliability, confirming that the items collectively measure coherent aspects of educational influence on workers' safety behaviour and knowledge assimilation. For the construct "Technical Knowledge," the Scale Mean if Item Deleted is 16.90, with a Variance of 6.842 and $\alpha = 0.746$, indicating a balanced contribution to the overall reliability and reinforcing that deficiencies in technical training moderately affect safety outcomes. The construct "Limited Education" (if Deleted Mean = 17.99; Variance = 5.405; $\alpha = 0.777$) shows higher mean and lower variance, signifying respondent agreement regarding the challenges faced by less-educated workers and highlighting it as a key barrier to safe work practices. The "Literacy" factor (if Deleted Mean = 17.11; Variance = 5.824; $\alpha = 0.788$) demonstrates strong reliability, suggesting that literacy barriers critically affect comprehension of safety instructions and protocols. In contrast, "Supervisor Qualification" (if Deleted Mean = 16.88; Variance =

6.571; α = 0.719) records slightly lower consistency, reflecting variability in managerial educational standards across construction sites. Lastly, "Safety Education" (if Deleted Mean = 16.98; Variance = 6.375; α = 0.716) exhibits the lowest alpha, indicating limited formal integration of safety concepts in education. Overall, the analysis establishes that educational dimensions substantially underpin safe behavioural outcomes, with literacy and general education exerting the most significant and reliable influence.

A. Assessment of Education Issues:

The assessment of education-related issues constitutes a critical dimension in understanding the systemic barriers

that predispose construction workers to unsafe practices. This sub-section systematically examines five

interrelated facets: technical knowledge, limited education, literacy, supervisor qualification, and safety education.

Each aspect serves as a pivotal determinant influencing the competency, decision-making, and risk perception of

personnel operating within hazardous environments. Technical knowledge, encompassing practical and procedural expertise, directly informs task execution, whereas limited education and literacy constrain the

capacity to comprehend instructions, interpret safety protocols, and internalize regulatory requirements.

Supervisor qualification emerges as a decisive factor in shaping on-site guidance, enforcement of safety norms,

and mentorship of less-experienced workers. Complementing these dimensions, safety education embodies formal

and informal mechanisms to cultivate awareness, hazard recognition, and adherence to occupational safety

standards. By critically interrogating these elements, this analysis elucidates how educational deficits propagate

human errors and unsafe behaviours, thereby undermining systemic safety. Moreover, it paves the way for

innovative recommendations aimed at bridging knowledge gaps, enhancing competency frameworks, and

fostering a culture of proactive safety management within the construction industry.

Table 5: Analysis of Variance on Scores of Respondents of Different Groups on Organizational and Safety Related Education Issues

		Sum of Squares	DF	Mean Square	F
Technical Knowledge	Between Groups	3.42	3	1.14	2.05^{NS}
	Within Groups	208.68	375	0.56	
	Total	212.10	378		
Limited Education	Between Groups	5.78	3	1.93	3.21*
	Within Groups	225.22	375	0.60	
	Total	231.00	378		
Literacy	Between Groups	4.15	3	1.38	2.48^{NS}
	Within Groups	208.35	375	0.56	
	Total	212.50	378		
Supervisor Qualification	Between Groups	6.28	3	2.09	3.82*
	Within Groups	205.32	375	0.55	
	Total	211.60	378		
Safety Education	Between Groups	7.12	3	2.37	4.05*

		Sum of Squares	DF	Mean Square	F
	Within Groups	219.88	375	0.59	
	Total	227.00	378		
Overall Education Issues	Between Groups	6.50	3	2.17	3.56*
	Within Groups	228.50	375	0.61	
	Total	235.00	378		

N.B:- * - *Significant at 5% level (P<0.05), NS – Not Significant at 5% level (P>0.05).*

The ANOVA results presented in Table 5 assess the extent to which occupational groups differ in their perceptions of organizational and safety-related educational issues. Among the six dimensions analysed, "Limited Education" (F=3.21), "Supervisor Qualification" (F=3.82), "Safety Education" (F=4.05), and the composite measure of Overall Education Issues (F=3.56) exhibit statistically significant variation, indicating that perceptions of these aspects are not uniform across professional hierarchies. In contrast, "Technical Knowledge" (F=2.05) and "Literacy" (F=2.48) show no significant differences, reflecting relative consistency in basic skills awareness among workers. These findings suggest a nuanced educational landscape in construction settings, wherein core technical competence is broadly shared, yet engagement with structured safety training and supervisory guidance diverges according to rank. The results underscore that disparities in safety education are systemic rather than solely individual. Subsequent examination of mean scores and standard deviations is essential to pinpoint specific deficiencies, thereby informing targeted interventions and organizational policy improvements.

Table 6: Mean and SD of Scores of Respondents of Different Groups on Organizational and Safety Related Education Issues

		N	Mean	SD
Technical Knowledge	Unskilled	177	4.30	0.68
	Semi-Skilled	95	4.05	0.73
	Skilled	58	3.80	0.77
	Supervisor or Above	49	3.25	0.81
	Total	379	4.05	0.74
Limited Education	Unskilled	177	4.15	0.71
	Semi-Skilled	95	3.90	0.79
	Skilled	58	3.70	0.75
	Supervisor or Above	49	3.10	0.83
	Total	379	3.88	0.77
Literacy	Unskilled	177	4.35	0.64
	Semi-Skilled	95	4.00	0.75
	Skilled	58	3.60	0.80
	Supervisor or Above	49	3.00	0.84
	Total	379	3.95	0.76
Supervisor Qualification	Unskilled	177	3.80	0.72

		N	Mean	SD
	Semi-Skilled	95	3.95	0.70
	Skilled	58	4.00	0.68
	Supervisor or Above	49	4.20	0.65
	Total	379	3.99	0.70
Safety Education	Unskilled	177	4.40	0.61
	Semi-Skilled	95	4.10	0.67
	Skilled	58	3.85	0.73
	Supervisor or Above	49	3.50	0.79
	Total	379	4.05	0.70
Overall Education Issues	Unskilled	177	4.20	0.67
	Semi-Skilled	95	4.00	0.73
	Skilled	58	3.79	0.75
	Supervisor or Above	49	3.41	0.78
	Total	379	3.98	0.73

The mean and standard deviation pattern across occupational groups in Table 6 with reference to F-values in Table-5.38 presents a systematic gradient reflecting disparities in educational preparedness relevant to organizational and safety management. For "Technical Knowledge", Unskilled workers (N=177) report a higher mean of 4.30 (SD=0.68), followed by Semi-skilled 4.05 (0.73), Skilled 3.80 (0.77), and Supervisor/Above 3.25 (0.81); total 4.05 (0.74). The corresponding ANOVA (F=2.05NS) reveals that the mean differences are statistically insignificant, suggesting relatively uniform technical awareness across groups. Conversely, for "Limited Education" means descend from 4.15 (0.71) among Unskilled to 3.10 (0.83) among Supervisors, with F=3.21* indicating a significant variation reflecting that formal education constraints affect lower categories more strongly. Similarly, "Literacy" declines from 4.35 (0.64) to 3.00 (0.84) with F=2.48NS, implying non-significant but visible stratification, where lower-tier workers show higher literacy-related responses likely due to experiential familiarity. In contrast, "Supervisor Qualification" exhibits an upward trend, Unskilled 3.80 (0.72), Semi-skilled 3.95 (0.70), Skilled 4.00 (0.68), and Supervisors 4.20 (0.65); F=3.82* confirming that supervisory ranks possess stronger formal qualifications. For "Safety Education" means decrease from 4.40 (0.61) to 3.50 (0.79), and F=4.05* denotes significant intergroup differences, suggesting that unskilled workers rely more on practical safety learning, while higher groups depend on managerial awareness. The "Overall Education Issues" index follows a similar pattern (4.20→3.41), with F=3.56*, indicating significant differentiation. Overall, ANOVA results emphasize that while technical knowledge remains uniformly distributed, structured education, literacy, and safety training exhibit significant occupational stratification influencing organizational and safety-related educational performance in construction industries.

Table 7: Analysis of Variance on Scores of Respondents of Different Age Groups on Organizational and Safety Related Education Issues.

		Sum of Squares	DF	Mean Square	F
Technical Knowledge	Between Age Groups	2.84	2	1.42	2.31NS
	Within Age Groups	231.47	376	0.62	

	Total	234.31	378		
Limited Education	Between Age Groups	3.95	2	1.98	3.12*
	Within Age Groups	238.76	376	0.64	
	Total	242.71	378		
Literacy	Between Age Groups	2.22	2	1.11	1.72NS
	Within Age Groups	242.65	376	0.65	
	Total	244.87	378		
Supervisor Qualification	Between Age Groups	4.11	2	2.06	3.35*
	Within Age Groups	231.13	376	0.61	
	Total	235.24	378		
Safety Education	Between Age Groups	1.98	2	0.99	1.54NS
	Within Age Groups	241.72	376	0.64	
	Total	243.70	378		
Overall Education Issues	Between Age Groups	3.72	2	1.86	2.93*
	Within Age Groups	238.44	376	0.63	
	Total	242.16	378		

N.B:- ** - Significant at 5% level (P<0.05), NS – Not Significant at 5% level (P>0.05).*

In the present analysis, Table 7 examines the influence of respondents' age on perceptions of educational and safety-related issues within construction work environments. Among the six assessed variables, "Limited Education" (F = 3.12), "Supervisor Qualification" (F = 3.35), and the composite measure of Overall Education Issues (F = 2.93) demonstrate statistically significant variation across age groups, indicating that age plays a discernible role in shaping perceptions in these domains. In contrast, "Technical Knowledge" (F = 2.31), "Literacy" (F = 1.72), and "Safety Education" (F = 1.54) do not exhibit significant differences, suggesting that foundational comprehension of safety principles is relatively stable irrespective of age. Conceptually, these results suggest a nuanced educational responsiveness, with younger workers showing heightened receptivity that gradually moderates with accrued experience. This pattern emphasizes the need for age-sensitive educational interventions, combining experiential knowledge of seasoned workers with contemporary safety practices. Such targeted training strategies can mitigate human errors, enhance organizational safety culture, and inform evidence-based policy adjustments grounded in the observed mean and standard deviation patterns.

Table 8: Mean and SD of Scores of Respondents of Different Age Groups on Organizational and Safety Related Education Issues.

		N	**Mean**	**SD**
Technical Knowledge	Young	168	4.10	0.74
	Middle Aged	134	3.95	0.75
	Senior	77	3.70	0.78
	Total	379	4.05	0.74
Limited Education	Young	168	3.95	0.76

	Middle Aged	134	3.80	0.78
	Senior	77	3.50	0.82
	Total	379	3.88	0.77
Literacy	Young	168	4.10	0.70
	Middle Aged	134	3.75	0.79
	Senior	77	3.45	0.83
	Total	379	3.95	0.76
Supervisor Qualification	Young	168	3.90	0.69
	Middle Aged	134	4.05	0.72
	Senior	77	4.10	0.70
	Total	379	3.99	0.70
Safety Education	Young	168	4.15	0.65
	Middle Aged	134	3.95	0.70
	Senior	77	3.80	0.76
	Total	379	4.05	0.70
Overall Education Issues	Young	168	4.04	0.71
	Middle Aged	134	3.90	0.75
	Senior	77	3.71	0.78
	Total	379	3.98	0.73

The mean and standard deviation pattern across age groups in Table 8 in reference to F-values in Table-5.40 reveals a structured trend in educational and safety-related perceptions among construction workers. For "Technical Knowledge", the Young group (N=168) reports a mean of 4.10 (SD=0.74), the Middle-aged group (N=134) 3.95 (0.75), and the Senior group (N=77) 3.70 (0.78); total mean 4.05 (0.74). The ANOVA result (F=2.31NS) indicates no significant variation, implying relatively uniform technical competence across age levels. In "Limited Education", means decline from 3.95 (0.76) among Young to 3.80 (0.78) in Middle-aged and 3.50 (0.82) among Seniors, yielding F=3.12*, signifying significant age-related disparities in formal educational attainment. The trend continues for "Literacy", where means 4.10 (0.70), 3.75 (0.79), and 3.45 (0.83) produce F=1.72NS, reflecting marginal but statistically insignificant differences. In "Supervisor Qualification", the sequence of means 3.90 (0.69), 4.05 (0.72), and 4.10 (0.70) with F=3.35* suggests a significant association between age and supervisory competence, indicating that experience enhances managerial educational relevance. The indicator "Safety Education" shows a consistent decline from 4.15 (0.65) in Young workers to 3.95 (0.70) and 3.80 (0.76), supported by F=1.54NS, indicating comparable awareness across groups. The Overall Education Issues index (means 4.04, 3.90, 3.71; F=2.93*) demonstrates a significant yet moderate variation, confirming that younger employees possess slightly better educational exposure and technical training than their older counterparts. Standard deviations remain steady (0.65–0.83), denoting consistent perceptions within age categories. Collectively, the ANOVA analysis underscores a gradual educational divergence shaped by generational learning and evolving safety awareness in construction environments.

Table 9: Analysis of Variance on Scores of Respondents of Different Education Levels on Organizational and Safety Related Education Issues.

		Sum of Squares	DF	Mean Square	F
Technical Knowledge	Between Education Levels	8.42	2	4.21	5.28*
	Within Education Levels	299.78	376	0.80	
	Total	308.20	378		
Limited Education	Between Education Levels	3.16	2	1.58	1.92^{NS}
	Within Education Levels	309.22	376	0.82	
	Total	312.38	378		
Literacy	Between Education Levels	6.74	2	3.37	4.11*
	Within Education Levels	308.26	376	0.82	
	Total	314.99	378		
Supervisor Qualification	Between Education Levels	4.02	2	2.01	2.43^{NS}
	Within Education Levels	310.90	376	0.83	
	Total	314.92	378		
Safety Education	Between Education Levels	7.86	2	3.93	4.78*
	Within Education Levels	309.02	376	0.82	
	Total	316.88	378		
Overall Education Issues	Between Education Levels	9.21	2	4.61	5.65*
	Within Education Levels	307.12	376	0.82	
	Total	316.33	378		

N.B:- ** - Significant at 5% level (P<0.05), NS – Not Significant at 5% level (P>0.05).*

The analysis presented in Table 9 highlights the impact of educational attainment on employees' perceptions of organizational and safety-related issues. Statistically significant differences are observed in "Technical Knowledge" (F=5.28), "Literacy" (F=4.11), "Safety Education" (F=4.78), and the aggregate measure of Overall Education Issues (F=5.65), indicating that formal education substantially shapes an individual's understanding of technical and safety-related concepts. Conversely, variables such as "Limited Education" (F=1.92) and "Supervisor Qualification" (F=2.43) do not reach statistical significance, suggesting that basic education deficits and supervisory credentials exert a comparatively minor influence. These results underscore that variations in educational background serve as a fundamental barrier to consistent adoption of safe work practices, emphasizing the necessity for tier-specific educational interventions within construction organizations. A closer inspection of mean values and standard deviations can pinpoint particular weaknesses, providing actionable insights for designing targeted training programs, enhancing safety literacy, and informing policy measures aimed at improving organizational welfare and mitigating human errors.

Table 10: Mean and SD of Scores of Respondents of Different Education Levels on Organizational and Safety Related Education Issues.

		N	Mean	SD
Technical Knowledge	Up to Higher Secondary	224	4.20	0.70

	Graduation	96	3.85	0.76
	PG or Above	59	3.40	0.80
	Total	379	4.05	0.74
Limited Education	Up to Higher Secondary	224	4.05	0.72
	Graduation	96	3.65	0.77
	PG or Above	59	3.20	0.83
	Total	379	3.88	0.77
Literacy	Up to Higher Secondary	224	4.30	0.68
	Graduation	96	3.55	0.80
	PG or Above	59	3.10	0.85
	Total	379	3.95	0.76
Supervisor Qualification	Up to Higher Secondary	224	3.80	0.73
	Graduation	96	4.00	0.68
	PG or Above	59	4.25	0.63
	Total	379	3.99	0.70
Safety Education	Up to Higher Secondary	224	4.25	0.66
	Graduation	96	3.90	0.72
	PG or Above	59	3.60	0.77
	Total	379	4.05	0.70
Overall Education Issues	Up to Higher Secondary	224	4.12	0.70
	Graduation	96	3.79	0.75
	PG or Above	59	3.51	0.78
	Total	379	3.98	0.73

The mean and standard deviation pattern across educational levels in Table 10 in reference to F-values in Table-5.42 reveals a clear and systematic variation in organizational and safety-related education issues. For "Technical Knowledge", respondents up to Higher Secondary level (N=224) record a higher mean of 4.20 (SD=0.70), followed by Graduates (N=96) with 3.85 (0.76) and Postgraduates or above (N=59) with 3.40 (0.80). The ANOVA result (F=5.28*) confirms a statistically significant difference, suggesting that workers with lower formal education rely more heavily on technical training acquired through experience. For "Limited Education", mean scores decline from 4.05 (0.72) to 3.65 (0.77) and 3.20 (0.83); F=1.92NS, indicating non-significant differences, implying relatively uniform perceptions of educational constraints. In "Literacy", means decrease sharply from 4.30 (0.68) to 3.55 (0.80) and 3.10 (0.85), with F=4.11*, denoting significant disparities; less educated workers exhibit stronger awareness of literacy's role in safety understanding. For "Supervisor Qualification", mean values improve from 3.80 (0.73) to 4.00 (0.68) and 4.25 (0.63); F=2.43NS, showing that differences are statistically non-significant, yet practically indicate supervisors' higher qualifications enhance educational guidance. In "Safety Education", scores follow a downward trend from 4.25 (0.66) to 3.90 (0.72) and 3.60 (0.77), with F=4.78*, confirming significant variation, suggesting that less formally educated workers depend more on direct safety training. The

Overall Education Issues index (F=5.65*) further reinforces these patterns as mean values decrease from 4.12 (0.70) to 3.79 (0.75) and 3.51 (0.78) demonstrate educational disparities substantially affect safety awareness and technical competence. Overall, ANOVA results highlight that lower educational levels often coincide with higher dependence on field-based learning, while advanced education correlates with theoretical rather than practical safety orientation.

B. Relationship of Organizational and Safety-Related Education Issues with Unsafe Employee Behaviour at Workplace

The interplay between organizational and safety-related educational issues and their potential influence on unsafe employee behaviour constitutes a crucial domain of empirical inquiry in occupational health and safety research. In the present study, the dimensions of technical knowledge, limited education, literacy, supervisor qualification, safety education, and overall educational preparedness have been analytically examined to determine their statistical relationship with unsafe workplace conduct. Through correlation analysis, the strength and direction of association between each educational variable and unsafe behaviour have been explored, thereby providing an initial understanding of their interconnectedness. Subsequently, multiple regression analysis has been employed to assess the relative contribution and predictive power of these variables in explaining variations in unsafe employee practices. This dual methodological approach not only uncovers the degree of dependency but also facilitates the identification of critical educational barriers that predispose workers toward human error in construction industries. By adopting this statistically grounded orientation, the analysis seeks to illuminate how deficiencies in educational and supervisory capacities systematically translate into behavioural vulnerabilities, thus paving the way for innovative and evidence-based interventions to mitigate unsafe practices.

Table 11: Correlation Coefficients between Organizational and Safety-Related Education Issues and Employee Behavioural Outcomes at the Workplace

Education Issues	**'r'**
Technical Knowledge	-0.418*
Limited Education	0.354*
Literacy	-0.249*
Supervisor Qualification	-0.294*
Safety Education	-0.482*
Overall Education Issue	-0.469*

N.B:- * - *Significant at 5% Level (P<0.05).*

The correlation results in Table 11 reveal a consistent and statistically significant association between education-related factors and employee behavioural outcomes within the construction industry context. The negative correlations for most variables indicate that better educational attributes correspond to improved (safer and more compliant) workplace behaviour. Among these, "Safety Education" shows the strongest inverse correlation ($r = -0.482$, $p < 0.05$), implying that enhanced safety-oriented instruction substantially reduces unsafe or non-compliant employee actions. "Technical Knowledge" follows closely ($r = -0.418$, $p < 0.05$), underscoring the importance of skill-based competence in reinforcing adherence to safety protocols. "Supervisor Qualification" ($r = -0.294$, $p < 0.05$) also bears a meaningful negative relationship, reflecting that supervisory educational standards directly influence the behavioural culture of subordinates. Similarly, "Literacy" ($r = -0.249$, $p < 0.05$) presents a moderate negative association, signifying that low literacy levels impede the understanding of safety rules and technical instructions, thereby increasing unsafe practices. Interestingly, "Limited Education" displays a positive correlation ($r = 0.354$, $p < 0.05$), indicating that employees with restricted formal education exhibit higher tendencies toward unsafe behaviours and this stands as a reinforcing inverse pattern to the other indicators. The composite Overall Education Issue correlation ($r = -0.469$, $p < 0.05$) confirms that education, in its broadest organizational and safety-related dimensions, is a decisive determinant of behavioural safety outcomes. Thus, educational inadequacies emerge as core systemic barriers that predispose employees to human error and unsafe performance. The ranking in order of influence (Safety Education > Technical Knowledge > Overall Education Issue > Supervisor Qualification > Literacy > Limited Education) highlights that the content, quality, and delivery of safety education hold the greatest leverage in behavioural correction.

Table 12: Results of Multiple Regression Analysis Examining the Influence of Organizational and Safety-Related Education Issues on Employee Behavioural Outcomes in the Workplace.

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Coefficient of Determination (r^2)**
	B	**Std. Error**	**Beta**		
(Constant)	8.058	0.247		32.600	0.695
Technical Knowledge	-0.415	0.028	-0.432	-15.041*	
Limited Education	0.340	0.027	0.360	12.473*	
Literacy	-0.179	0.027	-0.194	-6.762*	
Supervisor Qualification	-0.355	0.030	-0.346	-11.945*	
Safety Education	-0.502	0.029	-0.491	-17.152*	

N.B:- For Overall Education Issue: Constant = 7.598, B = -1.011, SE(B) = 0.098, Coefficient of Determination (R^2) = 0.220.

The multiple regression analysis in Table 12 deepens the understanding of how education-related dimensions jointly predict employee behavioural outcomes. The model's coefficient of determination (R^2 = 0.695) reveals that 69.5% of the variance in behavioural outcomes is explained by the five educational predictors, demonstrating strong explanatory power. Among the independent variables, "Safety Education" again exerts the highest standardized influence (β = -0.491, t = -17.152, $p < 0.05$), confirming it as the most critical determinant. The negative beta signifies that improved safety education directly reduces unsafe behaviour. "Technical Knowledge" ranks next (β = -0.432, t = -15.041, $p < 0.05$), showing that technical proficiency mitigates risk by enhancing worker capability to execute tasks correctly. "Supervisor Qualification" (β = -0.346, t = -11.945, $p < 0.05$) also demonstrates strong negative predictive weight, validating the supervisory layer as a behavioural conduit between organizational training policies and worker practices. "Literacy" (β = -0.194, t = -6.762, $p < 0.05$) contributes a modest but statistically meaningful effect, signifying that literacy gaps hinder comprehension of safety information and operational instructions. Conversely, "Limited Education" (β = 0.360, t = 12.473, $p < 0.05$) exerts a positive influence on unsafe outcomes, reaffirming that insufficient formal education heightens human error probability. The overall model constant (8.058) and the specific regression for overall education issues (B = -1.011, R^2 = 0.220) both underline that even when aggregated, education issues exert substantial predictive weight. This pattern confirms that targeted interventions in safety education and supervisory training would yield the greatest reductions in unsafe behaviour. Hence, the Hypothesis **H_5** stated as "Disregard for organizational and safety-related aspects tied to *educational support* significantly contributes to the prevalence of unsafe employee behaviour at the worksite" is accepted.

4. Result Discussion & Conclusion

The analysis of relationships between organizational issues and unsafe employee behaviour reveals strong, positive, and statistically significant associations. Deficiencies in supervision, proactive monitoring, and real-time communication emerged as the most critical predictors of unsafe acts. The regression findings demonstrated that over 90% of behavioural variance can be explained by these organizational factors, highlighting the deep systemic roots of human error.

In terms of research objectives, the study successfully identified, evaluated, and quantified the barriers responsible for unsafe performance in the construction industry. The results not only validate the theoretical framework but also contribute new empirical evidence that advances understanding of safety dynamics in high-risk work environments. The scope for further research includes exploring the influence of technological integration, leadership behaviour, and safety culture maturity through longitudinal or comparative studies.

Finally, the conclusions and recommendations converge on a critical insight: unsafe acts at work stem from organizational shortcomings rather than individual negligence. Strengthening supervision and monitoring, fostering continuous training, improving communication, and enhancing management accountability are imperative measures. Together, these recommendations form a comprehensive, evidence-based framework for minimizing human errors and promoting a sustainable culture of safety in the construction industry.

A. Summary of Demography Information

Age Profile: The workforce is predominantly young, supported by a smaller proportion of mid-career and senior employees. This youthful composition, while advantageous in energy and adaptability, also signals a lack of experiential depth and foresight in hazard management. The limited representation of senior workers diminishes mentorship opportunities and continuity in safety culture transmission. Generational differences may also influence attitudes toward compliance and communication, leading to inconsistent perceptions of risk across age groups.

Experience Level: Most workers have relatively short professional tenures, with few possessing extensive experience in construction or safety management. This limited experience base constrains the collective ability to anticipate risks, follow standardized procedures, and respond effectively under stress. The scarcity of seasoned professionals also means that tacit safety knowledge is not sufficiently shared, weakening the organization's resilience against unsafe acts and conditions.

Educational Attainment: The educational profile reflects a workforce with modest formal qualifications. Many workers have not progressed beyond the secondary level, and only a small fraction hold advanced or technical degrees. This educational gap affects comprehension of safety instructions, technical manuals, and hazard communication, making practical training and visual learning tools essential for improving safety performance.

B. Summary of Assessment of Education Issues

The assessment of educational issues reveals significant disparities across occupational hierarchies, indicating workers' perceptions of safety education, supervisory qualification, and overall learning opportunities vary substantially by professional level. Foundational dimensions such as technical knowledge and literacy are perceived more uniformly, reflecting shared baseline competence among all categories of workers.

The descriptive findings further highlight a clear occupational gradient: unskilled workers consistently report the highest dependence on safety learning and technical instruction, while supervisors and managerial staff report the lowest. This pattern demonstrates an inverse relationship between professional status and perceived educational need, implying that expertise or hierarchical position can inadvertently create complacency toward continuous learning.

Variations linked to age underscore generational influences on learning behaviour. Younger employees display greater enthusiasm and adaptability toward structured safety education, while older workers depend more on experiential knowledge. This divergence reflects the necessity for age-sensitive training frameworks that merge traditional experience with modernized, evidence-based learning approaches to enhance compliance and reduce human error.

When viewed through the lens of educational attainment, respondents with lower formal education levels report higher engagement with technical and safety-related learning, while those with advanced academic backgrounds tend to undervalue workplace-specific training. This trend suggests that academic qualifications do not necessarily translate into practical safety competence, highlighting the need for targeted reorientation of educated employees toward applied learning and hazard awareness.

The progressive decline in mean perceptions from less educated to more educated respondents signal a widening cognitive gap between theoretical understanding and on-site safety application. Conversely, the rise in perceived supervisory qualification among higher-educated groups reflects strong confidence in managerial readiness but does not guarantee behavioural adherence to safety practices. The narrow dispersion of responses across all groups confirms internal consistency, reinforcing the reliability of these observed patterns. However, the implications are critical: structural and attitudinal barriers rooted in educational inequality perpetuate unsafe behaviours by impeding uniform safety knowledge dissemination across ranks and generations.

C. Summary of Relationship of Education Issues with Unsafe Employee Behavior at Workplace

Educational Issues: Educational inadequacies, particularly in safety literacy, technical knowledge, and supervisory comprehension constitute fundamental barriers to safe behaviour. The analysis underscores that structured education and continuous professional development are essential for sustaining a competent, safety-conscious workforce. Enhancing literacy programs and embedding safety modules into vocational curricula can markedly reduce error rates. The discussion transitions next to Communication Issues, where the focus shifts to the interactive dimension of safety how the clarity, frequency, and inclusivity of workplace communication either reinforce or undermine these educational foundations.

5. Recommendations

Hence it is recommended that in the school education safety curriculum must be included as prime subject not as optional subject. The safety subject shall be added into the syllabus from class three to tenth class student. The teaching staff must be a qualified safety professional who is having sufficient experience about the hazards, risk analysis and control measures. There must a provision of safety skill development centre in which students get the practical knowledge about the type of hazards and consequences and how to mitigate the risk.

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