Impact of Occupational Health and Safety Training on Students' Safety Perception and Behavior

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ABSTRACT

Occupational Health and Safety (OHS) is a vital aspect of both educational and professional environments, especially in universities where students are frequently involved in laboratory and workshop activities that expose them to potential hazards. This study explores the impact of workplace policies and procedures on students' safety awareness and their active participation in safety practices. Using a quantitative approach, data were collected from undergraduate students through a structured questionnaire focusing on three key areas: workplace policies and procedures, OHS awareness, and participation in OHS activities. The data were analyzed using SmartPLS, which allowed for comprehensive evaluation of the measurement and structural models. The findings revealed a strong and significant relationship between workplace policies and OHS awareness, indicating that well-implemented policies, clear communication, and structured training greatly enhance students' understanding of safety practices and responsibilities. Furthermore, OHS awareness was found to play a crucial role in driving participation, showing that when students are more informed and knowledgeable about safety protocols, they are more likely to engage actively in reporting hazards, voicing concerns, and following safe practices. Although workplace policies also had a significant direct association with participation, this relationship was comparatively weaker, suggesting that awareness represents an important pathway through which policies may encourage participation. These results highlight the importance of fostering a culture of safety through continuous training and awareness programs rather than relying solely on policies. Practical recommendations include providing interactive and ongoing safety workshops, improving communication channels between students and staff, and regularly updating policies to address evolving safety needs. By combining robust policies with high levels of student engagement and awareness, universities can create safer learning environments and prepare future professionals who prioritize health and safety throughout their careers. This study contributes to the growing body of literature on safety education and provides a framework for improving OHS management in academic institutions.

Keywords: Occupational Health and Safety, Safety Awareness, Safety Participation, Workplace Policies, University Students

BACKGROUND OF THE STUDY

Occupational Health and Safety (OHS) is an important consideration in higher education, particularly in technical programs where students regularly participate in laboratory, workshop, and practical activities involving equipment, chemicals, and other potential hazards. In Malaysia, the Occupational Safety and Health Act 1994 provides an important framework for promoting safe practices and reducing occupational risks (OSHA, 1994). Although these principles are commonly applied in industrial workplaces, they are equally relevant to universities because students must develop appropriate safety knowledge and behavior before entering professional practice (Nor et al., 2020). Clear policies, regular communication, appropriate training, and opportunities for students to participate in safety activities can strengthen safety awareness and encourage proactive behavior (Clarke, 2013)(Huang et al., 2016). Students who understand their safety responsibilities are more likely to recognize hazards, follow procedures, report unsafe conditions, and intervene appropriately when risks arise (Vinodkumar & Bhasi, 2010). Therefore, examining how institutional safety policies are associated with students' awareness and participation is important for strengthening safety culture in higher education.

Problem Statement

Despite the increasing emphasis on OHS, gaps remain in how safety requirements are understood and practiced by university students. Previous studies have associated inadequate training and communication with weaker safety practices among students and trainees (Abd Hamid et al., 2021)(Nor et al., 2020)(Wahi et al., 2022). Students may also be uncertain about their rights and responsibilities, appropriate reporting procedures, or their ability to raise safety concerns (Abdullah & Aziz, 2020)(Ibrahim et al., 2023). Such limitations may reduce the effectiveness of institutional safety policies even when formal procedures are available. Within Malaysian higher education, further empirical evidence is needed to explain how institutional safety policies are associated with students' OHS awareness and active participation. Accordingly, this study examines the influence of workplace policies and procedures on OHS awareness, the influence of OHS awareness on participation in safety practices, and the direct influence of workplace policies and procedures on participation. The findings are intended to support universities in improving safety training, communication, hazard reporting, and student engagement.

LITERATURE REVIEW

OHS in higher education encompasses institutional policies, knowledge, and behaviors intended to prevent injuries and promote safe learning environments. Students in laboratory and workshop-based programs may encounter risks similar to those experienced in industrial settings, making appropriate safety knowledge and behavior an important component of professional preparation. This review therefore focuses on the three constructs examined in the study: workplace policies and procedures, OHS awareness, and participation in OHS practices.

Overview of Occupational Health and Safety (OHS)

Occupational Health and Safety (OHS) refers to policies, procedures, and activities intended to prevent injuries, illnesses, and other harm. In Malaysia, OSHA 1994 provides the principal legal framework for workplace health and safety (OSHA, 1994). Its underlying principles are also relevant to academic laboratories and workshops, where students may face comparable hazards (Nor et al., 2020). OHS education therefore contributes not only to accident prevention but also to developing a safety-conscious mindset that students can carry into professional practice (Huang et al., 2016).

Workplace Policies and Procedures

Workplace policies and procedures provide the formal structure through which safety expectations are communicated and implemented. Effective arrangements commonly include training, hazard identification, reporting procedures, incident investigation, communication, and mechanisms for participation (Vinodkumar & Bhasi, 2010). In universities, clearly communicated policies can help students understand expected behavior and institutional safety priorities, while visible commitment to safety can strengthen trust and encourage reporting and compliance (Clarke, 2013)(Neal & Griffin, 2006). Effective policies are therefore expected to contribute to both students' OHS awareness and their participation in safety practices.

Occupational Health and Safety Awareness

OHS awareness refers to students' understanding of safety rights, responsibilities, procedures, precautions, hazard reporting, and appropriate responses to safety concerns. Safety knowledge is important because institutional policies can influence behavior only when individuals understand how those requirements apply to their activities (Vinodkumar & Bhasi, 2010). In university laboratories and workshops, adequate awareness enables students to recognize hazards, select appropriate precautions, and respond appropriately to unsafe

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conditions (Abdullah & Aziz, 2020). Awareness therefore represents an important mechanism through which institutional safety arrangements may be translated into safety behavior.

Participation in OHS Practices

Safety participation extends beyond basic compliance and includes proactive behaviors such as reporting hazards, raising safety concerns, suggesting improvements, and contributing to collective safety activities. Individuals are more likely to participate when they perceive that management or institutional representatives support safety and will respond constructively to their concerns (Neal & Griffin, 2006). Within universities, encouraging students to participate in safety discussions and reporting systems can strengthen shared responsibility and promote a more proactive safety culture (Hasan & Ibrahim, 2023).

Theoretical Framework

This study is guided by Safety Climate Theory and Social Exchange Theory. Safety Climate Theory proposes that individuals form perceptions of the importance placed on safety through organizational policies, practices, communication, and management priorities (Zohar, 2010). In a university context, consistent safety policies and communication can therefore signal that safety is an institutional priority and strengthen students' OHS awareness. Social Exchange Theory complements this explanation by suggesting that individuals respond positively when they perceive that an organisation values and supports their well-being. When students perceive genuine institutional commitment to their safety, they may reciprocate through constructive safety behaviors, including reporting hazards, raising concerns, and participating in safety activities (Huang et al., 2016). Together, these theories provide a basis for explaining the expected sequence in which institutional policies strengthen safety awareness and greater awareness encourages active safety participation.

RESEARCH METHODOLOGY

A well-structured methodology is vital to ensure the research process is systematic, reliable, and capable of addressing the study’s objectives. This section describes the research design, target population, sampling method, data collection instruments, procedures, and statistical analyses employed to investigate how workplace policies, OHS awareness, and participation influence students’ safety perceptions and behaviors. The methodology was designed to capture both the breadth and depth of students’ experiences with OHS training and practices, providing a robust framework for answering the research questions outlined in the introduction. By adopting a quantitative approach, this study seeks to provide empirical evidence on the effectiveness of OHS training and its impact on students’ attitudes and actions.

Research Design

This study used a quantitative, cross-sectional survey design to capture a clear picture of the current safety climate among students at a single point in time. This approach was chosen because it is both practical and efficient, allowing data to be gathered from a large group of participants quickly while still providing reliable insights into the relationships between key factors (Creswell, 2009)(Bryman, 2012)(Kumar, 2011). The research focused on three main areas: Workplace Policies and Procedures, which look at how institutional rules and safety systems influence student behavior; Occupational Health and Safety Awareness, which explores students’ understanding of safety rights, responsibilities, and proper procedures; and Participation in OHS, which examines how willing and confident students are to report hazards and take part in safety initiatives. These factors were studied in relation to the main outcome of interest students’ safety perception and behavior which reflects how they think about safety and how they act to keep themselves and others safe.

Population and Sampling

The target population for this study consisted of undergraduate students at Universiti Teknologi MARA (UiTM) who are actively involved in laboratory or workshop sessions, as these environments expose them to potential hazards and make them ideal for assessing the effectiveness of OHS training. To ensure fair representation, a stratified random sampling method was used, taking into account two key factors: students’ year of study (from Year 1 to Year 4) and intake type (diploma or matriculation), as these could influence their prior exposure to

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safety practices. Using the Slovin formula, the minimum sample size was calculated to be 120 students at a 95% confidence level and a 5% margin of error. To address potential non-responses, the target was increased to 150 students, and a strong response rate was achieved with 144 completed surveys, providing a reliable and diverse dataset for the study.

Research Instrument

Data for this study were gathered using a structured questionnaire designed around the study's objectives and adapted from established safety assessment tools. The questionnaire included four main sections: Section A, which captured demographic details such as gender, age, academic year, and intake type; Section F, which measured perceptions of workplace policies and procedures; Section G, which assessed students' understanding of safety responsibilities; and Section H, which evaluated their willingness to report hazards and actively participate in safety practices. Sections F, G, and H used a five-point Likert scale ranging from *Strongly Disagree (1)* to *Strongly Agree (5)*. To ensure accuracy, the questionnaire was reviewed by OHS experts for content validity, and a pilot test with 20 students was conducted to check for clarity and usability. Reliability was confirmed using Cronbach's Alpha, with values of 0.70 or higher deemed acceptable. Ethical approval was obtained prior to data collection, and students were informed about the purpose of the study, with assurances of confidentiality and voluntary participation. Questionnaires were distributed both in laboratory sessions and online over a four-week period, allowing flexibility for students with different schedules and commitments.

Analysis Techniques

The data collected in this study were analyzed using SmartPLS version 4, which applies Partial Least Squares Structural Equation Modeling (PLS-SEM). This method was chosen because it is well-suited for studies that focus on prediction and theory development, particularly with smaller sample sizes and complex models. The analysis began with data preparation, which involved screening for missing values, checking for outliers, and examining data distribution to ensure readiness for analysis. The first stage, measurement model assessment, focused on evaluating the reliability and validity of the questionnaire. This included testing indicator reliability, internal consistency (Cronbach's Alpha and Composite Reliability), convergent validity (Average Variance Extracted), discriminant validity (Fornell-Larcker Criterion and HTMT), and multicollinearity using VIF values. Once validated, the structural model assessment was conducted to test the hypothesized relationships between workplace policies, OHS awareness, participation, and students' safety behaviors. This involved examining path coefficients, bootstrapping for significance testing, and assessing model performance through R^2, effect size (f^2), predictive relevance (Q^2), and overall model fit (SRMR). The final step involved hypothesis testing, where relationships between constructs were confirmed or rejected based on statistical significance. This structured approach allowed the study to accurately identify the factors that most strongly influence students' safety perceptions and behaviors.

Ethical Considerations

Ethical considerations were prioritized throughout the study. Participants were informed of the study's purpose and provided with the option to withdraw at any stage without penalty. No identifying information was collected, ensuring participant anonymity and confidentiality. Data were securely stored and used solely for academic purposes.

RESULTS

The analysis was conducted using SmartPLS to assess the measurement and structural models. Figure 1 presents the proposed research model. The measurement model was evaluated first to establish indicator reliability, internal consistency, convergent validity, and discriminant validity, followed by assessment of the structural relationships among workplace policies and procedures, OHS awareness, and participation in safety practices. The measurement-model results are reported in Tables 1-5, while Tables 6-13 present collinearity, path coefficients, significance testing, explanatory power, effect sizes, predictive relevance, model-fit indices, and hypothesis-testing results. Each table is discussed immediately after presentation to connect the statistical evidence with the corresponding model assessment.

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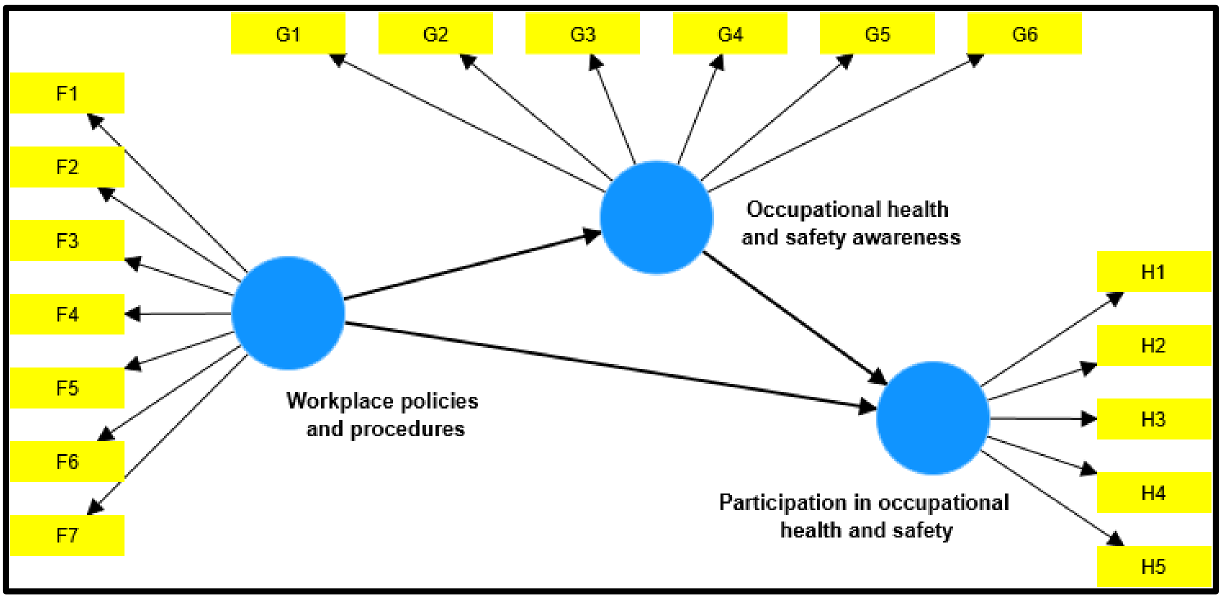

Figure 1: Research model

Measurement Model Assessment (Outer Model)

As illustrated in Figure 1, the measurement model specifies the indicators used to measure Workplace Policies and Procedures, OHS Awareness, and Participation in OHS. The assessment examined indicator reliability, internal consistency, convergent validity, and discriminant validity before the structural relationships were interpreted (Joseph F. Hair et al., 2022).

Indicator Reliability (Outer Loadings)

Table 1: Outer Loadings

	Outer Loadings			
F	**Workplace policies and procedures: At my workplace ....**	Occupational health and safety awareness	Participation in occupational health and safety	Workplace policies and procedures
F1	Everyone receives the necessary workplace health and safety training when starting a job, changing jobs or using new techniques			0.917
F2	There is regular communication between employees and management about safety issues			0.948
F3	Systems are in place to identify, prevent and deal with hazards at work			0.931
F4	Workplace health and safety is considered to be at least as important as production and quality			0.947
F5	There is an active and effective health and safety committee and/or worker health and safety rep			0.938
F6	Incidents and accidents are investigated quickly in order to improve workplace health and safety			0.908

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F7	Communication about workplace health and safety procedures is done in a way that I can understand			0.939
G	**Occupational health and safety awareness: At my workplace ....**			
G1	I am clear about my rights and responsibilities in relation to workplace health and safety	0.943		
G2	I am clear about my employers' rights and responsibilities in relation to workplace health and safety	0.919		
G3	I know how to perform my job in a safe manner	0.937		
G4	If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to	0.936		
G5	I have the knowledge to assist in responding to any health and safety concerns at my workplace	0.913		
G6	I know what the necessary precautions are that I should take while doing my job	0.923		
H	**Participation in occupational health and safety: At my workplace ....**			
H1	I feel free to voice concerns or make suggestions about workplace health and safety at my job		0.923	
H2	If I notice a workplace hazard, I would point it out to management		0.907	
H3	I know that I can stop work if I think something is unsafe and management will not give me a hard time		0.931	
H4	If my work environment was unsafe I would not say anything, and hope that the situation eventually improves (reverse scored)		0.587	
H5	I have enough time to complete my work tasks safely		0.899	

The outer loadings presented reflect how well each survey item measures its respective construct, which in this study includes Workplace Policies and Procedures (F), Occupational Health and Safety Awareness (G), and Participation in Occupational Health and Safety (H). Outer loadings above 0.70 are generally considered acceptable, indicating a strong relationship between the item and the underlying construct (Joseph F. Hair et al., 2022). For Workplace Policies and Procedures (F), all seven items showed very high outer loadings, ranging from 0.908 to 0.948, well above the recommended threshold. This suggests that the questions related to training, communication, hazard management, safety committees, incident investigations, and clarity of procedures are highly reliable indicators of workplace policies. It indicates that respondents had a consistent understanding of these factors, and each item strongly reflects the institution's safety management practices. Similarly, Occupational Health and Safety Awareness (G) demonstrated excellent reliability, with loadings between 0.913 and 0.943. These results imply that students clearly understood their safety-related rights and responsibilities, knew the correct reporting procedures for hazards, and were aware of the necessary precautions required to perform tasks safely. Such high values indicate that the awareness items were well-designed and accurately captured the construct being measured. For Participation in Occupational Health and Safety (H), four indicators showed strong outer loadings ranging from 0.899 to 0.931. Item H4, a reverse-scored statement, recorded a lower loading of 0.587. This suggests that the item may have been interpreted less consistently than the other participation indicators. Because the construct retained satisfactory composite reliability and AVE, H4 was retained for the present analysis, but its wording should be refined and reassessed in future applications of the instrument.

Internal Consistency Reliability

Table 2: Construct reliability and validity

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Occupational health and safety awareness	0.968	0.968	0.974	0.862
Participation in occupational health and safety	0.908	0.945	0.932	0.739
Workplace policies and procedures	0.975	0.976	0.979	0.869

The results for construct reliability and validity demonstrate that the measurement model used in this study is both strong and highly reliable. Firstly, Cronbach’s Alpha values for all three constructs are well above the minimum threshold of 0.70, indicating excellent internal consistency among the survey items. Specifically, *Occupational Health and Safety Awareness* scored 0.968, *Participation in Occupational Health and Safety* scored 0.908, and *Workplace Policies and Procedures* scored 0.975. These high values mean that the items within each construct consistently measure the same underlying concept, giving confidence in the reliability of the data. Similarly, Composite Reliability (CR) values, both rho_a and rho_c, exceed 0.70, confirming that the constructs demonstrate strong internal reliability. For instance, the CR (rho_c) for *Occupational Health and Safety Awareness* is 0.974, *Participation in OHS* is 0.932, and *Workplace Policies and Procedures* is 0.979. These figures suggest that the indicators are highly dependable and produce stable results, reinforcing the robustness of the model. Furthermore, the Average Variance Extracted (AVE) for each construct is well above the recommended cut-off of 0.50, indicating excellent convergent validity (Fornell & Larcker, 1981). This means that the majority of variance in the observed variables is captured by the underlying constructs rather than by error. *Occupational Health and Safety Awareness* had an AVE of 0.862, *Participation in OHS* was 0.739, and *Workplace Policies and Procedures* recorded 0.869. These high values reflect that the survey items effectively represent their intended concepts. In simpler terms, these findings confirm that the questionnaire used in this study is both reliable and valid, providing a solid foundation for further analysis. Students’ responses consistently and accurately reflect their perceptions of workplace policies, safety awareness, and participation in safety practices, allowing the study to confidently proceed with testing relationships between these constructs.

Discriminant Validity

Table 3: Fornell-Larcker Criterion

Construct	Occupational health and safety awareness	Participation in occupational health and safety	Workplace policies and procedures
Occupational health and safety awareness	0.928		
Participation in occupational health and safety	0.77	0.86	
Workplace policies and procedures	0.816	0.711	0.932

Table 3 presents the Fornell-Larcker Criterion, which is used to assess discriminant validity the extent to which each construct in the study is truly distinct from the others. According to the rule of thumb, the square root of the Average Variance Extracted (AVE), shown on the diagonal, should be greater than the correlation values between constructs (Fornell & Larcker, 1981). In this study, the square roots of the AVE for *Occupational Health*

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and Safety Awareness (0.928), *Participation in OHS* (0.860), and *Workplace Policies and Procedures* (0.932) are all higher than their corresponding correlation values with other constructs. For example, the correlation between *Occupational Health and Safety Awareness* and *Participation in OHS* is 0.770, which is lower than 0.928. Similarly, the correlation between *Workplace Policies and Procedures* and *Occupational Health and Safety Awareness* is 0.816, which is lower than 0.932. These results indicate strong discriminant validity, confirming that each construct measures a unique aspect of occupational health and safety without overlapping excessively with other constructs.

Table 4: Heterotrait-Monotrait Ratio (HTMT)

Construct	Occupational health and safety awareness	Participation in occupational health and safety	Workplace policies and procedures
Occupational health and safety awareness			
Participation in occupational health and safety	0.792		
Workplace policies and procedures	0.839	0.735	

Table 4 shows the Heterotrait-Monotrait Ratio (HTMT), another method for assessing discriminant validity. For discriminant validity to be established, the HTMT values should generally be below 0.90 (Henseler et al., 2015). In this study, all HTMT values meet this criterion. The relationship between *Occupational Health and Safety Awareness* and *Participation in OHS* is 0.792, while the relationship between *Workplace Policies and Procedures* and *Occupational Health and Safety Awareness* is 0.839, and between *Workplace Policies and Procedures* and *Participation in OHS* is 0.735. Since all values are comfortably below the 0.90 threshold, these findings further confirm that the constructs are clearly distinct from one another. Together, the results in Table 3 and Table 4 provide strong evidence of discriminant validity. This means that the three constructs — workplace policies and procedures, occupational health and safety awareness, and participation in OHS — are conceptually different, ensuring that the model accurately reflects the unique dimensions of students' safety perceptions and behaviors.

Multicollinearity Assessment (VIF)

Table 5: Outer Model Indicator VIF

Indicators	F1	F2	F3	F4	F5	F6	F7	G1	G2	G3	G4	G5	G6	H1	H2	H3	H4	H5
VIF	5.343	8.004	5.963	7.596	6.183	5.204	6.733	7.908	4.796	7.633	7.030	5.111	5.492	3.973	3.725	4.602	1.475	3.283

Table 5 presents the Variance Inflation Factor (VIF) values for each indicator in the outer model, which are used to assess multicollinearity among the survey items. A VIF value below 5.0 is generally considered acceptable, indicating that the item does not share excessive variance with other items measuring the same construct (Joseph F. Hair et al., 2022). However, values above 5.0 suggest potential multicollinearity concerns that may need to be addressed. Several outer-model indicators exceeded the VIF threshold of 5.0. All seven Workplace Policies and Procedures indicators (F1-F7) recorded VIF values above 5.0, ranging from 5.204 to 8.004. For OHS Awareness, five of six indicators (G1, G3, G4, G5, and G6) exceeded 5.0, while G2 recorded 4.796. In contrast, all Participation indicators (H1-H5) remained below 5.0, ranging from 1.475 to 4.602. The elevated values for the F and G constructs indicate potential item redundancy and should be acknowledged when interpreting the measurement model. Future instrument refinement may streamline closely overlapping statements while preserving construct content.

Structural Model Assessment (Inner Model)

Once the measurement model was validated, the structural model was tested to examine the hypothesized relationships between constructs (e.g., whether workplace policies influence awareness, which in turn affects participation and safety behavior).

Collinearity Assessment

Table 6: Inner model

Constructs	VIF
Occupational health and safety awareness -> Participation in occupational health and safety	2.993
Workplace policies and procedures -> Occupational health and safety awareness	1
Workplace policies and procedures -> Participation in occupational health and safety	2.993

Table 6 presents the Variance Inflation Factor (VIF) values for the inner model, which are used to evaluate multicollinearity among the predictor constructs in the structural model. A VIF value below 5.0 indicates that multicollinearity is not a problem and that the constructs are sufficiently distinct from each other when predicting outcomes (Joseph F. Hair et al., 2022). The results show that all three relationships in the inner model have VIF values well below the threshold. The path from Occupational Health and Safety Awareness → Participation in Occupational Health and Safety has a VIF of 2.993, which is comfortably within acceptable limits. Similarly, the path from Workplace Policies and Procedures → Participation in Occupational Health and Safety also has a VIF of 2.993, indicating that these two predictors do not excessively overlap when explaining participation behavior. This suggests that both constructs provide unique and valuable contributions in predicting how students engage in health and safety practices. Interestingly, the path from Workplace Policies and Procedures → Occupational Health and Safety Awareness has a VIF value of 1.000, which is ideal and reflects no multicollinearity at all. This indicates that workplace policies are an independent and distinct predictor of students' safety awareness without interference from other constructs. Overall, the results in Table 6 confirm that multicollinearity is not an issue within the structural model. This means the relationships between workplace policies, awareness, and participation can be interpreted with confidence, as each construct independently contributes to understanding students' safety perceptions and behaviors.

Path Coefficients

Table 7: Path coefficients

Constructs	Path coefficients
Occupational health and safety awareness -> Participation in occupational health and safety	0.568
Workplace policies and procedures -> Occupational health and safety awareness	0.816
Workplace policies and procedures -> Participation in occupational health and safety	0.248

Table 7 displays the path coefficients, which indicate the strength and direction of relationships between the constructs in the structural model. These values help to understand how strongly one construct influences another, with coefficients closer to +1 representing a stronger positive relationship (Joseph F. Hair et al., 2022). The results show that the path from Workplace Policies and Procedures → Occupational Health and Safety Awareness has the highest coefficient at 0.816. This suggests a very strong and positive relationship, meaning that when workplace policies are clear, well-communicated, and effectively implemented, they significantly enhance students' understanding and awareness of occupational health and safety practices. This finding highlights the critical role of institutional policies in shaping students' knowledge and attitudes toward safety.

The path from Occupational Health and Safety Awareness → Participation in Occupational Health and Safety has a coefficient of 0.568, indicating a moderate to strong positive influence. This suggests that students who are more aware of safety procedures and responsibilities are more likely to actively engage in safety practices, such as reporting hazards, voicing concerns, and taking steps to maintain a safe environment. In other words, awareness acts as a motivator for proactive participation. Lastly, the direct path from Workplace Policies and Procedures → Participation in Occupational Health and Safety shows a coefficient of 0.248, which is positive but relatively weaker compared to the other relationships. This implies that while workplace policies have some direct influence on students' participation in safety activities, the overall pattern suggests that awareness is an important pathway linking policies with participation. Policies alone therefore appear less strongly associated with participation than students' understanding and internalisation of those policies. Overall, the results in Table 7 suggest a clear sequence: strong workplace policies enhance safety awareness, which in turn encourages higher levels of participation. This emphasizes the importance of investing in comprehensive training and communication strategies to bridge the gap between policies and actual safety behaviors.

Bootstrapping for Significance Testing

Table 8: Bootstrapping for Significance Testing

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Occupational health and safety awareness -> Participation in occupational health and safety	0.568	0.571	0.126	4.514	<0.001
Workplace policies and procedures -> Occupational health and safety awareness	0.816	0.815	0.039	20.93	<0.001
Workplace policies and procedures -> Participation in occupational health and safety	0.248	0.246	0.115	2.164	0.030

Table 8 presents the results of bootstrapping for significance testing, which evaluates whether the relationships between constructs in the structural model are statistically significant. In PLS-SEM, significance is determined by looking at the t-statistic and p-value. A t-value greater than 1.96 and a p-value less than 0.05 indicate that the relationship is statistically significant at the 5% level (Joseph F. Hair et al., 2022). The path from Workplace Policies and Procedures → Occupational Health and Safety Awareness shows the strongest relationship, with an original sample estimate of 0.816, a very high t-value of 20.93, and $p < 0.001$. These results clearly indicate that workplace policies have a highly significant and positive impact on enhancing students' awareness of health and safety practices. This highlights the critical role that well-implemented policies and procedures play in shaping how students understand and engage with safety standards. The path from Occupational Health and Safety Awareness → Participation in Occupational Health and Safety also demonstrates a strong and significant relationship, with an original sample estimate of 0.568, a t-value of 4.514, and $p < 0.001$. This suggests that students who are more aware of safety procedures and their responsibilities are significantly more likely to actively participate in safety practices, such as reporting hazards or voicing concerns. In other words, awareness directly motivates proactive safety behavior. Finally, the path from Workplace Policies and Procedures → Participation in Occupational Health and Safety shows a weaker but still significant effect, with an original sample estimate of 0.248, a t-value of 2.164, and a p-value of 0.030. While this relationship is statistically significant, it indicates that policies alone have a modest direct influence on participation. This implies that policies are more effective when they first build awareness, which then drives active engagement and involvement. Overall, Table 8 confirms that all three relationships in the model are statistically significant. The strongest effect is from workplace policies to awareness, followed by the impact of awareness on participation. These findings emphasize that clear, well-communicated policies are essential for increasing awareness, which in turn fosters higher levels of student participation in creating a safe learning environment.

Coefficient of Determination (R^2)

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Table 9: Coefficient of Determination (R^2)

Construct	R-square	R-square adjusted
Occupational health and safety awareness	0.666	0.664
Participation in occupational health and safety	0.614	0.608

Table 9 presents the coefficient of determination (R^2) values, which indicate how well the independent variables explain the variance in the dependent variables within the structural model. In PLS-SEM, R^2 values are interpreted as follows: 0.75 is considered substantial, 0.50 moderate, and 0.25 weak (Joseph F. Hair et al., 2022). These values help us understand the model's explanatory power and effectiveness. For Occupational Health and Safety Awareness, the R^2 value is 0.666, with an adjusted R^2 of 0.664. This means that 66.6% of the variance in safety awareness can be explained by workplace policies and procedures. This is a strong and meaningful result, indicating that clear and effective workplace policies play a crucial role in shaping how students understand and perceive occupational health and safety issues. The small difference between R^2 and adjusted R^2 also shows that the model is stable and reliable. For Participation in Occupational Health and Safety, the R^2 value is 0.614, with an adjusted R^2 of 0.608. This suggests that 61.4% of the variance in participation is explained by both workplace policies and safety awareness. This is considered a moderately strong result, highlighting that when students are both aware of safety practices and supported by well-established policies, they are much more likely to actively engage in safety-related activities, such as reporting hazards or voicing concerns. Overall, the findings in Table 9 indicate that the model has good predictive power. Workplace policies strongly influence awareness, and together, awareness and policies significantly drive students' participation in safety practices. This reinforces the importance of having clear safety systems and continuous awareness programs to encourage active involvement in maintaining a safe learning environment.

Effect Size (f^2)

Table 10: Effect Size (f^2)

Construct	f-square
Occupational health and safety awareness -> Participation in occupational health and safety	0.279
Workplace policies and procedures -> Occupational health and safety awareness	1.993
Workplace policies and procedures -> Participation in occupational health and safety	0.053

Table 10 shows the effect size (f^2), which evaluates the individual contribution of each predictor construct to the R^2 value of the dependent constructs. In other words, it helps to determine how strongly one variable impacts another within the model. According to (Cohen et al., 1998) guidelines, f^2 values are interpreted as follows: 0.02 = small effect, 0.15 = medium effect, and 0.35 = large effect. The relationship between Workplace Policies and Procedures → Occupational Health and Safety Awareness shows an exceptionally high effect size of 1.993, which is far beyond the threshold for a large effect. This result highlights that workplace policies play a critical and dominant role in shaping students' safety awareness. It suggests that when policies are clear, comprehensive, and well-enforced, they have a powerful and direct influence on how well students understand safety responsibilities and procedures. The path from Occupational Health and Safety Awareness → Participation in Occupational Health and Safety has an effect size of 0.279, which falls between medium and large. This indicates that students' awareness significantly drives their active involvement in safety activities, such as reporting hazards, speaking up about unsafe practices, and following safety protocols. Essentially, the more informed students are, the more likely they are to take proactive steps toward maintaining a safe environment. Finally, the path from Workplace Policies and Procedures → Participation in Occupational Health and Safety shows a small effect size of 0.053. This suggests that while policies do have a direct impact on participation, the effect is relatively minor compared to when policies first build awareness. This supports the idea that policies alone are not enough to encourage active participation students must first fully understand and internalize them for meaningful engagement to occur. In summary, Table 10 demonstrates that workplace policies are the foundation for cultivating safety awareness, which then becomes the key driver for participation. This reinforces the importance of comprehensive policies coupled with effective awareness programs to foster a strong safety culture among students.

Predictive Relevance (Q^2)

Table 11: Predictive Relevance (Q^2)

Construct	SSO	SSE	Q^2 (=1-SSE/SSO)
Occupational health and safety awareness	864.000	376.157	0.565
Participation in occupational health and safety	720.000	409.923	0.431
Workplace policies and procedures	1008.000	1008.000	0.000

Table 11 presents the results of Predictive Relevance (Q^2), which is used to assess how well the structural model predicts the observed data. In PLS-SEM, Q^2 values are generated using the blindfolding procedure, and a value greater than 0 indicates that the model has predictive relevance (Joseph F. Hair et al., 2022). The higher the Q^2 value, the stronger the model's predictive capability for that construct. For Occupational Health and Safety Awareness, the Q^2 value is 0.565, which is considered high predictive relevance. This means the model strongly predicts students' level of safety awareness based on workplace policies and procedures. It suggests that when institutions have clear and well-implemented safety policies, they can accurately anticipate how aware students will be regarding occupational health and safety practices. For Participation in Occupational Health and Safety, the Q^2 value is 0.431, which also reflects a moderate to strong predictive relevance. This indicates that the model is effective in predicting students' active involvement in safety activities, such as reporting hazards, voicing concerns, and following safe work practices. The combination of workplace policies and students' awareness provides a reliable explanation of why some students engage more actively in safety efforts than others. In contrast, Workplace Policies and Procedures show a Q^2 value of 0.000, as expected, because this construct functions as an exogenous variable (independent variable). Since it is not predicted by other variables in the model, it does not have a Q^2 value. Overall, the results in Table 11 confirm that the model has strong predictive relevance, especially for safety awareness and participation. This demonstrates that focusing on effective policies and enhancing awareness are key strategies for anticipating and improving safety behaviors among students.

Model Fit Indices

Table 12: Model Fit Indices

	Saturated model	Estimated model
SRMR	0.049	0.049
Chi-square	377.217	377.217
NFI	0.896	0.896

Table 12 presents selected model-fit indices. The SRMR value for both the saturated and estimated models was 0.049, which is below the commonly cited threshold of 0.08 (Joseph F. Hair et al., 2022), indicating a small average discrepancy between observed and model-implied correlations. The NFI value was 0.896, which is close to 0.90. These indices provide supplementary information on overall model-data correspondence; however, they should not be interpreted as proof that individual hypothesised relationships are accurate. The chi-square value was 377.217. Because chi-square is sensitive to sample size and PLS-SEM primarily emphasizes prediction and explained variance, the model-fit indices were interpreted together with the path coefficients, R^2, f^2, and Q^2 results rather than as stand-alone evidence of model quality.

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Hypothesis Testing

The final stage of the analysis involved evaluating the hypotheses formulated to determine whether the proposed relationships between the constructs were statistically supported. This was achieved by examining the results of the structural model, particularly the path coefficients, t-statistics, and p-values, as presented in Tables 7 and 8. Hypotheses were classified as supported or not supported based on the significance and strength of these values, with the decision guided by a t-value greater than 1.96 and a p-value below 0.05 (Joseph F. Hair et al., 2022). By doing so, the study was able to identify which factors exert the strongest influence on students' safety perceptions and behaviors, providing clear insights into the relationships among workplace policies, safety awareness, and participation.

Table 13: Hypothesis Testing Results

	Hypotheses	Path coefficient	Std. dev.	T-value	p	Result
H1	Workplace policies and procedures have a positive influence on occupational health and safety awareness *This indicates that clear and effective workplace policies strongly enhance students' understanding and awareness of occupational health and safety. It highlights the fundamental role of institutional policies in educating and guiding students toward safe practices.*	0.816	0.039	20.93	<.001	Supported
H2	Occupational health and safety awareness positively influences participation in occupational health and safety *This suggests that students with higher levels of safety awareness are more likely to engage actively in safety-related activities, such as reporting hazards, voicing concerns, and adhering to safety protocols. Awareness acts as a driving force behind proactive safety behaviors.*	0.568	0.126	4.514	<.001	Supported
H3	Workplace policies and procedures have a direct positive influence on participation in occupational health and safety. *Although the relationship is statistically significant, the effect is relatively modest. This implies that policies alone do not strongly drive participation unless they first build a solid foundation of awareness among students.*	0.248	0.115	2.164	.030	Supported (weaker effect)

All three hypotheses were supported. The strongest relationship was observed between workplace policies and OHS awareness (H1), followed by the relationship between awareness and participation (H2). The direct relationship between workplace policies and participation (H3) was significant but weaker. This pattern suggests that awareness may represent an important pathway through which institutional policies are translated into active safety participation; however, statistical mediation should only be claimed if the specific indirect effect is separately tested and reported.

DISCUSSION

The strongest relationship identified in this study was between Workplace Policies and Procedures and OHS Awareness ($\beta = 0.816$, $p < 0.001$), with a large effect size ($f^2 = 1.993$). This result can be interpreted through Safety Climate Theory, which proposes that individuals develop perceptions of safety priorities from organizational policies, communication, and practices (Zohar, 2010). Within a university environment, clearly communicated procedures, training requirements, hazard-management systems, and visible institutional commitment signal that safety is an organizational priority. Students exposed to these consistent signals are therefore more likely to understand their responsibilities and the procedures required to manage hazards. The finding is consistent with previous research emphasising structured policies, communication, and safety leadership as foundations of safety behavior (Clarke, 2013)(Ibrahim et al., 2023).

OHS Awareness also had a significant positive relationship with OHS Participation ($\beta = 0.568$, $p < 0.001$; $f^2 = 0.279$). This finding indicates that awareness is not merely an informational outcome; it is associated with students' willingness to translate safety understanding into action. Students who understand reporting channels, precautions, responsibilities, and appropriate responses to hazards are better positioned to raise concerns, report unsafe conditions, and participate in preventive activities. From the perspective of Social Exchange Theory, participation may also represent a positive response to perceived institutional support. When students perceive that their institution provides appropriate safety knowledge, resources, and support, they may reciprocate through greater involvement in maintaining a safe learning environment (Huang et al., 2016).

Although Workplace Policies and Procedures were directly associated with OHS Participation, this relationship was comparatively weaker ($\beta = 0.248$, $p = 0.030$; $f^2 = 0.053$). This distinction is important because it shows that simply establishing rules is less strongly associated with behavioral participation than ensuring that those rules are understood. The pattern of relationships is consistent with a pathway in which policies strengthen awareness and awareness subsequently encourages participation. Nevertheless, the direct-path results alone do not confirm statistical mediation; a bootstrapped specific indirect effect would be required to establish that conclusion.

The model explained 66.6% of the variance in OHS Awareness ($R^2 = 0.666$) and 61.4% of the variance in OHS Participation ($R^2 = 0.614$). Q^2 values of 0.565 and 0.431, respectively, further indicate predictive relevance for the two endogenous constructs. These findings suggest that institutional policy and student awareness account for substantial variation in safety-related participation, while also leaving room for other influences such as leadership, peer norms, psychological safety, prior experience, and institutional culture.

The findings have direct practical implications for Malaysian universities. Safety induction should be reinforced through periodic refresher programs rather than treated as a one-off activity. Universities should maintain clear two-way communication and hazard-reporting channels, provide feedback on reported concerns, and use practical activities such as drills, laboratory-specific briefings, and scenario-based exercises to help students translate safety knowledge into behavior. Student representatives should also be involved in safety committees or consultation activities to strengthen participation and shared responsibility. Regular evaluation of students' awareness and participation can help institutions determine whether existing policies are being understood and translated into safe practice.

Limitations and Future Research

Several limitations should be considered when interpreting the findings. First, the study relied on self-reported questionnaire data, which may be affected by social-desirability bias and may not fully correspond with observed safety behavior. Future studies could triangulate questionnaire responses with behavioral observations, incident or near-miss records, and other objective indicators. Second, the sample comprised 144 undergraduate students from Universiti Teknologi MARA who were involved in laboratory or workshop activities. The findings should therefore not be generalized automatically to all Malaysian universities, disciplines, or student populations. Multi-institutional studies across different regions and program types would provide stronger evidence regarding the broader applicability of the model. Third, the cross-sectional design captures perceptions at a single point in time and does not establish causal change. Cultural and contextual factors, including willingness to question authority, perceived psychological safety, communication norms, and leadership support, were also not directly

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measured. Future research could use longitudinal designs to assess changes before and after OHS training and incorporate qualitative interviews or focus groups to explore how these contextual factors shape safety participation.

CONCLUSION

This study demonstrates that workplace policies and procedures are strongly associated with university students' OHS awareness and that greater awareness is associated with more active participation in safety practices. The strongest relationship was identified between workplace policies and OHS awareness, while awareness showed a stronger relationship with participation than the direct relationship between policies and participation. These findings emphasize that formal policies are most useful when they are clearly communicated, understood, and reinforced through meaningful student engagement. For Malaysian universities, improving OHS outcomes therefore requires an integrated approach that combines compulsory safety induction with periodic refresher training, accessible hazard-reporting and feedback systems, practical drills and scenario-based activities, student involvement in safety consultation, and regular policy review in response to emerging risks. These measures can help translate institutional safety requirements into sustained awareness and proactive participation. The findings should nevertheless be interpreted within the limitations of the single-institution, cross-sectional, and self-reported design; future multi-institutional and longitudinal research incorporating qualitative and behavioral evidence would strengthen understanding of how university safety culture develops over time.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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