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Mediating Role of Safety Behavior in The Relationship of OSH Knowledge and Job Safety Analysis with Mitigation Risks in Culinary Laboratories

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Abstract

Risk mitigation is a fundamental concept that students must understand. This understanding can help ensure personal safety during laboratory practicals. Additionally, it helps build character and foster a culture of safety, both of which are professional standards in the global hospitality industry. This study aims to determine the direct and indirect effects of occupational safety and health (OSH) knowledge, job safety analysis, and safety behavior on risk mitigation in culinary laboratories. Data were collected via a questionnaire distributed to 123 undergraduate culinary arts students at a university in Surabaya. The PLS-SEM model was used to analyze the data and confirm the research hypotheses. The results indicate that OSH knowledge has a positive and significant effect on safety behavior and risk mitigation in culinary laboratories. On the other hand, Job Safety Analysis was found to influence Safety Behavior and to have a significant impact on risk mitigation in culinary laboratories. Similarly, Safety Behavior was shown to positively influence risk mitigation. These findings indicate that fostering safety behaviors from an early age not only minimizes physical hazards in the workplace, but also prepares future hospitality professionals to foster safe and decent working environments in the global market. This study can also serve as a reference for policymakers when designing pre-internship standard operating procedures that include workplace safety analyses to support continuing education.

Keyword: *Job Safety Analysis, OSH Knowledge, Safety Behavior, Risk Mitigation*

Introduction

Improving safety in culinary laboratories is fundamental to ensuring a safe academic environment for students and instructors during practical training [1,2]. These laboratories present unique challenges because they combine aspects of both

food safety and occupational safety. Therefore, an integrated and comprehensive safety approach is needed to mitigate the risks of accidents, contamination, and potential health hazards in the kitchen area [3]. The implementation of effective safety practices is not only important for protecting the entire academic community during lab sessions but also for fostering sustainable safety habits crucial to students' future professional success in the food industry [4]. This integration supports sustainable development goals (SDG) by providing a safe and healthy laboratory environment for students.

Risk mitigation is crucial for culinary students because educational kitchen labs combine the risks of physical injury, food safety hazards, and human error within a single training environment [5]. Managing risks early on will prevent minor issues from escalating into major crises. Students in this learning phase are highly prone to human error, which can result in serious physical injuries [such as burns or cuts] and damage to university facilities if they lack a strong understanding of risk mitigation. Mastering risk mitigation competencies early on not only protects students' personal safety during practical training but also shapes their character and fosters a safety culture, key standards of professionalism as they enter the global hospitality industry [6]. Instilling risk mitigation skills from an early age can help achieve the SDG on decent work by fostering a culture of workplace safety.

The success of risk mitigation in culinary laboratories depends heavily on the safety behaviors demonstrated by students during practical sessions. Educational institutions may have provided safe kitchen facilities, established strict Standard Operating Procedures (SOP), and supplied complete Personal Protective Equipment (PPE) [Ali et al., 2022]. However, all these safety management measures will not be able to optimally reduce potential hazards if students do not internalize them into concrete actions. Safety behavior, which includes safety compliance [such as wearing standard chef's attire] and safety participation [such as peers reminding one another], serves as an operational bridge that transforms written regulations into effective preventive measures [8].

Student safety behavior is a core component of laboratory safety management [9]. Culinary students interact intensively with various sources of extreme hazards during practical sessions in the culinary laboratory. This high-risk interaction requires strong internalization of safety behaviors to ensure that every action students take does not result in a fatal mistake. Students who make a habit of consciously practicing safe behavior will develop effective self-protection against physical injury. Mastering safety behavior in an academic setting also benefits students in the long term. The habit of practicing safe behavior in the laboratory fosters character, discipline, and a high level of professionalism key assets as they transition into the global commercial hospitality industry, which enforces extremely strict safety standards [6].

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internalization of safety behaviors so that every action students take does not result in a fatal mistake. Students who make a habit of consciously practicing safe behavior will develop effective self-protection against physical injury. Mastering safety behavior in an academic setting also benefits students in the long term. The habit of safe behavior in the laboratory will foster character, discipline, and a high level of professionalism, key assets as they transition into the global commercial hospitality industry, which has very strict safety standards.

Structurally, the development of robust safety behavior is influenced by two key determinants: Occupational Safety and Health (OSH) knowledge and the implementation of Job Safety Analysis. OSH knowledge contributes to cognitive capacity and safety literacy, enabling students to develop a deep awareness of latent hazards around them [10]. This theoretical knowledge is abstract and therefore insufficient on its own to produce safe actions [11]; it requires Job Safety Analysis. Job Safety Analysis is a method for hazard identification and qualitative risk assessment that specifically focuses on hazards posed by the tasks to be performed [12]. Integrating Job Safety Analysis into this learning environment enables students to systematically identify latent hazards and implement preventive controls, thereby transforming theoretical safety knowledge into consistent preventive behavior [13]. Many retrospective studies have found that the proper application of Job Safety Analysis is effective in preventing accidents [14]

The synergistic combination of OSH Knowledge and Job Safety Analysis has been shown to foster students' mental preparedness and behavioral agility for safe laboratory work [9,15]. Students equipped with a solid foundation in OSH Knowledge will find it easier to understand and comply with all safety instructions outlined in the Job Safety Analysis document [16]. When students consistently apply the control measures outlined in the Job Safety Analysis, grounded in their OSH Knowledge, positive safety behavior will develop within the laboratory. The cultivation of safety behavior, which arises from the integration of theoretical understanding and practical task guidelines, ultimately becomes the most effective, proactive, and sustainable risk-mitigation strategy for creating an accident-free culinary learning ecosystem [17].

A number of previous studies have extensively documented the important role of OHS knowledge and Job Safety Analysis in reducing workplace accident rates across various sectors. Previous researchers have demonstrated that a high level of OHS knowledge is positively correlated with increased worker hazard awareness [18]. Similarly, regarding the implementation of Job Safety Analysis, several empirical studies confirm that task-based breakdown of work steps can significantly eliminate technical risks in the field [19]. Evaluations of safety interventions also indicate that changes in safety behavior are key to bridging the gap between management regulations and reductions in actual incident rates [20].

Although the literature on OSH is already extensive, most previous studies still leave a significant research gap because they focus too heavily on the heavy industry sector. Scientific research to date has been dominated by OSH studies in the

manufacturing, construction, mining, and hospital sectors. Researchers have rarely addressed vocational education laboratories, particularly culinary laboratories. In fact, culinary laboratories exhibit unique and dynamic risk characteristics because they simultaneously integrate hazards such as fire, hot oil, sharp objects, and slippery surfaces in the same workspace.

Due to the limitations of the conceptual models used by previous researchers, most OSH studies in academic settings have examined only the direct relationship between theoretical knowledge and accident rates using simple descriptive analyses. Previous researchers rarely integrated practical management tools, such as Job Safety Analysis, with cognitive factors (OSH Knowledge) into a single comprehensive structural model. Furthermore, the mediating mechanism of safety behavior in translating knowledge and Job Safety Analysis into actual risk mitigation has not yet been thoroughly explored in the context of culinary education.

This study was specifically designed to address these research gaps using Structural Equation Modeling (SEM). It tests an integrative model that positions safety behavior as a mediating variable between OHS Knowledge and the implementation of Job Safety Analysis in relation to the success of risk mitigation in culinary laboratories. Shifting the focus of this research from heavy industry to culinary vocational education laboratories is expected to provide new theoretical contributions to the global occupational safety literature. The results of this study are also expected to offer practical contributions in the form of proactive mitigation guidelines for administrators of culinary education institutions to ensure the safety of student interns and support effective risk mitigation in culinary laboratories. This structural model serves as a new framework for ensuring safety in the field, aligned with the culinary vocational education system and global sustainability standards in the industry.

Literature Review

Social Cognitive Theory

Social Cognitive Theory, developed by Albert Bandura, serves as the fundamental theoretical framework for analyzing the formation of students' safety behaviors. The core of this theory is that human behavior results from a dynamic interaction among three main factors: personal factors, environmental factors, and behavior itself [21]. In the context of workplace safety in culinary laboratories, these three elements of the triad do not exist in isolation; rather, they influence one another to shape a safe work ecosystem. The application of the triadic interaction in Social Cognitive Theory in this study is fully reflected in the integration of the variables under investigation. The personal factor in this model is represented by the OHS Knowledge variable, which reflects students' mental capacity, literacy, and theoretical understanding of kitchen risks. The environmental factor is represented by the implementation of Job Safety Analysis, which serves as an external stimulus through regulations, structured work procedures, and administrative engineering within the

laboratory. The interaction between students' cognitive awareness and the clarity of Job Safety Analysis guidelines in the kitchen area will simultaneously stimulate the emergence of a third factor: positive safety behavior during culinary practicum sessions.

Bandura's theory also emphasizes the importance of learning through observation and self-reinforcement in achieving desired outcomes [22]. Students who possess a solid foundation of OSH knowledge and are accustomed to following the steps of a Job Safety Analysis will be able to predict the consequences of their every action in the kitchen. This predictive awareness encourages students to voluntarily exhibit compliant and participatory behavior [23]. In the final phase of this reciprocal determinism model, the consistent cultivation of safety behaviors among trainees will directly lead to effective risk mitigation [24], thereby reducing the actual rate of workplace accidents in the culinary laboratory to its lowest possible level. The application of reciprocal determinism in this study provides a stronger theoretical foundation for achieving the Sustainable Development Goal on Quality Education. Educational institutions can build a safe, inclusive, and resilient learning ecosystem for student teachers by fostering a balanced interaction between cognitive health, safety knowledge, and a structured physical environment.

Behavior-Based Safety

Behavior-Based Safety theory is a workplace safety approach that prioritizes modifying human behavior as the primary means of reducing workplace accident rates [25,26]. The fundamental principle of this theory posits that most workplace incidents are not caused by technical system failures or machinery malfunctions, but rather are triggered by unsafe acts repeatedly performed by workers [27]. In a fast-paced and dynamic operational environment, written safety rules are often ignored when workers face time pressure or physical fatigue. Therefore, Behavior-Based Safety serves to bridge the gap between cognitive safety knowledge and actual on-site actions through a systematic intervention process [28]. This approach focuses on conditioning safe behavior so that it becomes a reflex or habit for individuals as they perform their daily work, thereby improving safety [25,29].

The implementation of Behavior-Based Safety theory in an operational environment relies on a consistent cycle of observation, feedback, and behavioral reinforcement [30–32]. This process begins with identifying critical behaviors that may cause harm, followed by peer observation to assess on-the-job compliance [33]. When unsafe actions are identified, immediate and persuasive feedback is provided to correct the error without a punitive tone. Conversely, recognition is given for safe actions to reinforce workers' motivation to maintain such positive behaviors. Through these measurable, behavior-based interventions, safety compliance is no longer driven by fear of regulatory sanctions but rather grows from an internal awareness that shapes a strong safety culture within the organization [34]. Behavior-focused training that prioritizes internalized safety habits, prepares future culinary professionals, and

maintains a safe work environment aligns with the SDG of decent work and economic growth.

Hypothesis Development

1. Occupational Health and Safety (OSH) Knowledge and Safety Behavior

Safety Knowledge Influences Safety Behavior refers to the relationship between what people know and understand about safety procedures and how they apply that knowledge in real-world scenarios, particularly in the workplace [35]. This concept is crucial for fostering a strong safety culture and preventing accidents and injuries in the laboratory. OSH knowledge serves as the primary cognitive foundation for the formation of students' safety behavior during culinary laboratory activities [36]. OSH knowledge in culinary education settings encompasses not only a theoretical understanding of regulations but also involves a deep awareness of specific kitchen hazards. Students with strong safety knowledge are more likely to follow safety practices and anticipate the negative consequences of unsafe acts [37]. This relationship between knowledge and behavior aligns with the principle of triadic interaction in Social Cognitive Theory, whereby an increase in cognitive understanding directly transforms how students act [behavior] in the kitchen laboratory environment [20,21].

The integration of OSH knowledge into culinary students' motor activities simultaneously and consistently strengthens both the dimensions of safety compliance and safety participation [20]. An increase in depth of understanding of these safety regulations has been empirically shown to transform students' passive awareness into tangible protective actions at culinary workstations. Based on this theoretical framework and empirical evidence, the first hypothesis of this study is formulated as follows:

Hypothesis 1 (H1): OHS Knowledge berpengaruh positif dan signifikan terhadap Safety Behavior.

2. Job Safety Analysis and Safety Behavior

The implementation of Job Safety Analysis is a structured approach that directly guides the development of students' safety behavior, particularly in culinary laboratories [38]. Job Safety Analysis serves as an operational guide that breaks down each step of following a recipe into a logical sequence of tasks, identifies potential hazards, and determines control measures [19]. The use of a Job Safety Analysis matrix is effective in reducing injuries and enhancing safety culture [25]. Students who are consistently exposed to Job Safety Analysis worksheets before turning on a stove or operating production machinery will exhibit higher levels of safety behavior [19].

This process of habit formation through task-based risk analysis transforms written safety instructions into tangible preventive actions at each student's workstation. Discipline in following this safe work sequence will gradually foster protective and systematic work habits [39]. The use of the Job Safety Analysis tool in vocational laboratories has proven effective in bridging the gap between institutional OSH regulations and the safety behaviors students demonstrate in the field [19]. Based on this theoretical framework and the empirical findings, the second hypothesis of this study is formulated as follows.

Hypothesis 2 (H2): Job Safety Analysis Implementation berpengaruh positif dan signifikan terhadap Safety Behavior.

3. Occupational Safety and Health (OSH) Knowledge and Risk Mitigation

OSH knowledge is a direct predictor of successful risk mitigation in culinary laboratories [36]. Comprehensive OSH knowledge equips culinary students with a deep understanding of the characteristics of physical, chemical, and biological hazards in practical kitchen settings [40]. This cognitive maturity enables students to independently take appropriate preventive measures to mitigate potential hazards before they become actual incidents. The ability to identify hazards early, which stems from mastery of OSH literacy, is a key determinant in minimizing the likelihood of physical injuries during cooking activities [41].

Empirical evidence shows that mastery of both the theoretical and practical aspects of OSH is directly correlated with reduced near-miss incidents and the protection of laboratory assets from physical damage [40]. High safety literacy changes students' mindset in assessing risks, enabling them to take countermeasures quickly, tactically, and in a measured manner [36]. Investing in students' individual understanding of OSH has proven effective in mitigating the risk of material losses and maintaining the long-term functionality of vocational kitchen facilities [42]. Based on this theoretical framework and empirical evidence, the third hypothesis of this study is formulated as follows:

Hypothesis 3 [H3]: OSH Knowledge berpengaruh langsung secara signifikan terhadap Risk Mitigation.

4. Job Safety Analysis and Risk Mitigation

The implementation of Job Safety Analysis serves as a practical tool that determines the success of risk mitigation in culinary laboratories [38]. The Job Safety Analysis worksheet provides a written overview of the sequence of cooking tasks, potential hazards at each stage, and preventive measures that students must take [43]. Identifying hazards specifically for each stage of the task helps students anticipate workplace accidents before motor activities in the

kitchen begin. Students who follow the Job Safety Analysis guidelines can take appropriate preventive measures, such as positioning the pan handle correctly or ensuring that evacuation routes are not blocked by piles of food ingredients. Discipline in applying this safe work sequence directly reduces the injury rate among students during practical training [39].

The implementation of Job Safety Analysis in culinary arts laboratories has also proven effective in reducing the frequency of near-miss incidents and preventing damage to kitchen facilities [19]. Students accustomed to reviewing task safety aspects can detect minor damage to gas lines or blender cables before the equipment is used. These prompt corrective actions protect workstations from the risk of grease fires or electrical short circuits in mechanical equipment [44]. Structured task analysis bridges the gap between occupational safety theory and real-world conditions in the field, thereby minimizing the potential for material losses from the outset [38]. Based on this line of reasoning and the results of field testing, the fourth hypothesis in this study is formulated as follows:

Hypothesis 4 (H4): Job Safety Analysis has a significant direct impact on risk mitigation.

5. Safety Behavior and Risk Mitigation

Safety behavior exhibited by students is a key factor in the success of risk mitigation in culinary laboratories [20,45]. This safety behavior encompasses two main dimensions: students' adherence to kitchen rules [safety compliance] and their active participation in maintaining a safe practical training environment [safety participation] [46]. Students who consistently practice safe behaviors such as wearing protective footwear, using thick cloths when handling hot pots, and cutting food ingredients with proper techniques reduce the likelihood of accidents [44]. These concrete actions in the lab serve as the primary defense against physical injuries, such as cuts or burns, during food preparation [47].

Protective measures taken collectively by students have also proven effective in reducing the frequency of near-miss incidents and preventing damage to laboratory facilities [48]. Students who practice good safety behavior will immediately dry wet floors without waiting for instructions from instructors or kitchen technicians. This proactive step prevents the risk of other students slipping while carrying hot equipment [47]. Students will also be more careful in cleaning and maintaining expensive culinary production equipment to avoid mechanical damage. This behavioral awareness at the individual level creates a controlled work environment, thereby minimizing potential losses to institutional assets [20,45]. Based on these theoretical connections and empirical evidence, the fifth hypothesis in this study is formulated as follows:

Hypothesis 5 (H5): Safety Behavior has a positive and significant effect on Risk Mitigation

6. The Mediating Role of Safety Behavior

Safety behavior acts as an operational bridge linking cognitive factors and regulatory instruments to the success of risk mitigation in culinary laboratories [45]. A solid understanding of OSH knowledge will not have a tangible impact on reducing accident rates if students do not apply that understanding through safe practices in the kitchen [37]. Students' safety behavior translates theoretical knowledge of the hazards posed by fire, gas, and sharp objects into concrete protective actions at their workstations. Students who consciously translate safety knowledge into daily compliance will be more effective in reducing injury rates and mitigating the risk of lab failure [1,25,44].

A similar mediation process also occurs in the relationship between the implementation of Job Safety Analysis and risk mitigation in culinary settings [43]. The availability of Job Safety Analysis worksheets will remain merely a passive administrative document unless they are internalized into students' work habits while cooking [13,19]. Students' safety behaviors serve as the mechanism that brings each stage of the safe work sequence designed in the Job Safety Analysis matrix to life. Trainees' discipline in responding to potential hazards in accordance with these task guidelines directly minimizes near-miss incidents and protects kitchen facilities from damage [39]. The mechanism of active mediation of safety behavior translates basic theoretical knowledge into concrete risk mitigation actions. These actions directly protect the physical health and well-being of student interns from everyday kitchen hazards, which are also linked to the SDG of Good Health and Well-being. Based on this conceptual framework and the results of the empirical testing, the sixth and seventh hypotheses in this study are formulated as follows:

Hypothesis 6 (H6): Safety Behavior mediates the relationship between OSH Knowledge and Risk Mitigation.

Hypothesis 7 (H7): Safety Behavior mediates the relationship between Job Safety Analysis Implementation and Risk Mitigation.

[insert] Fig 1. Conceptual Research Model

Methods

Research design

This study employs a quantitative, correlational, and cross-sectional approach to examine the relationship between OHS knowledge and Job Safety Analysis implementation and risk mitigation through safety behavior. Since this study aims to validate the theory and related hypotheses, Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted using SmartPLS 4.0.

Participant

This study was conducted in the culinary arts program at a state university in Surabaya, Indonesia. Respondents were selected through non-probability sampling based on convenience. According to [49], this technique is easily accessible to researchers because individuals are selected based on non-random criteria, and not all individuals may be included. According to Hair et al [50], an appropriate sample size is determined by applying the 10-times rule and considering that the model being tested comprises four relationships. A total of 123 respondents agreed to participate in this study, exceeding this minimum requirement.

Participants were provided with a self-administered questionnaire via Google Forms to be completed at their convenience. To comply with ethical requirements regarding unreported opinions, we initially informed respondents that the questionnaire was for academic purposes only and assured them that their information would be kept confidential.

Instruments development

Data collection was conducted using a structured questionnaire. This questionnaire was developed and designed based on previous research and relevant literature. The four variables in this study: OHS knowledge, job safety analysis, behavioral safety, and risk mitigation were adapted from previous research and measured on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument had been validated in a previous study. The questionnaire was translated from English to Indonesian through a back-translation process. Two translators translated the questionnaire from English to Indonesian. A third translator then back-translated the resulting version into English to verify that it accurately reflected the original wording.

1. Occupational Safety and Health (OSH) Knowledge

The OHS Knowledge Instrument was measured using six items from a cognitive perception instrument adapted from the safety knowledge dimension developed [36]. This instrument evaluates students' theoretical understanding of kitchen hazard identification, safe work procedures, emergency operations, handling flammable materials, use of PPE, and fire mitigation.

2. Job Safety Analysis

The Job Safety Analysis instrument used in this study was adapted from the concept of task-based safety analysis stages [38], which was then modified into a self-perception scale in the form of a questionnaire to make it suitable for completion by students in a culinary laboratory setting. This instrument consists of 6 items. The following are some examples of the items: 1) I am able to identify potential hazards at each stage of the cooking recipe listed on the safety sheet; 2) I always double-check the condition of kitchen equipment (knives, blenders, stoves) before using them during lab sessions.

3. Safety Behavior

The safety behavior instrument used in this study was adapted from [20]. The instrument consists of eight items grouped into two dimensions: safety participation and safety compliance. This instrument consists of six statements. Some examples of items are “I help my coworkers when they are working in risky or hazardous conditions” (safety participation) and “I use the correct safety procedures to perform my work” (safety compliance).

4. Mitigate Risks

The risk mitigation instrument used in this study was measured using a student self-perception questionnaire adapted from the safety outcomes dimension developed [36]. This instrument consists of 9 statements representing injury rate reduction, near-miss mitigation, and property damage prevention.

Pilot Study

Content validation testing was conducted to ensure the instrument's validity and reliability. This validation process involved subject-matter and language experts from our university to solicit advice and feedback. The researcher revised the instrument based on the experts' feedback and suggestions, ensuring that no items were omitted. A pilot test of the instrument was conducted with 30 respondents after the revisions were completed for exploratory factor analysis (EFA). Based on the EFA results, all items met the threshold values. These EFA results were then used to collect data in the field, followed by confirmatory factor analysis (CFA) and structural equation modeling (SEM).

Data analysis

Factor analysis was conducted using SmartPLS 4.0 to assess the causal relationships in the research instrument data. These statistical tests were intended to assess convergent validity, discriminant validity, and construct reliability before conducting hypothesis testing to interpret the research results. This analytical

procedure will facilitate the development of an integrative model that defines the roles of OHS Knowledge and Job Safety Analysis in shaping students' safety behavior and optimizing risk mitigation in culinary laboratories.

Result

This analysis is based on the application of the Partial Least Squares Structural Equation Modeling (PLS-SEM) model to evaluate the relationships among the latent variables: OHS Knowledge, Job Safety Analysis, Safety Behavior, and risk mitigation.

Measurement model

Convergent validity

Convergent validity reflects the degree of certainty that all selected indicators accurately represent the same latent variable [51]. This validity is assessed based on the magnitude of the outer loadings and the Average Variance Extracted (AVE). Indicators with high loading values indicate a strong alignment in measuring the theoretical construct under study. The accuracy of this measurement ensures that the variance of the latent variable can be optimally explained by its constituent indicators within the model.

This study sets the standard values for outer loading and AVE at 0.500 as the minimum threshold for indicator acceptability [52]. The results for outer loading and AVE are presented in Table 1. The data in Table 2 show that the factor loadings and AVE values are above 0.500. These results confirm that all indicators in this study have met the required criteria for convergent validity. The weakest items were still found in OSH.2, OSH.3, SB.6, and MR.8, which remain valid as initial-stage reflective indicators, while the strongest item was SB.4. These findings strongly confirm that each questionnaire item is understood uniformly by culinary students and successfully reflects its original theoretical construct in a valid manner.

[insert] Table 1. Outer loading of dan AVE results.

Figure 2 illustrates the structural model tested in this study. The visualization shows the flow of relationships among latent constructs, including OSH Knowledge (OSH), Job Safety Analysis (JSA), Safety Behavior (SB), and Mitigate Risks (MR), complete with the factor loadings of their respective indicators. All indicators for each latent variable have been statistically validated. The results of the first path estimation indicate that OSH Knowledge is positively related to Safety Behavior, with a coefficient of 0.277. The OSH Knowledge variable was also found to be positively related to Mitigate Risks, with a coefficient of 0.303. The second path shows that Job Safety Analysis positively influences Safety Behavior with a coefficient of 0.475. The Job

Safety Analysis instrument also exhibits a positive relationship with Mitigate Risks, with a coefficient of 0.267. The final path confirms that Safety Behavior has a strong positive relationship with Mitigate Risks, with a coefficient of 0.439. The visual representation in Figure 2 shows the results of the PLS algorithm calculations in SmartPLS. A more in-depth discussion of the significance levels of each relationship between these variables will be presented in the following section.

[insert] Fig 2. Convergent validity

Discriminant validity

Discriminant validity measures the extent to which a latent variable is conceptually distinct from other latent variables within the research model. This test ensures that the indicators of a construct do not correlate more strongly with other, unrelated constructs. The accuracy of discriminant validity can be empirically evaluated using the Fornell and Larcker indices, the Heterotrait-Monotrait Ratio (HTMT), and cross-loading values. Research indicators are considered to have passed the test if their factor loadings on the target latent variable are significantly larger than their loadings on other latent variables.

Fornell and Larcker's method.

Table 2 presents a summary of the validity test results using the Fornell-Larcker criteria. The testing rules for this method stipulate that the square root of a variable's AVE must be greater than the correlation coefficient between that variable and any other variable in the model [53]. Based on the calculations, the job safety analysis variable has a square-root AVE of 0.773. This value exceeds its correlation coefficients with the variables "Mitigate Risks" (0.477), "OSH Knowledge" (0.003), and "Safety Behavior" (0.476). Similar results were found in the validity tests for all other research variables. These evaluation results indicate that all measurement items in the study met the criteria for good discriminant validity based on the Fornell-Larcker method.

[insert] Table 2. Fornell and Lacker's criteria for discriminant validity.

HTMT results.

Hair et al. [2019] recommend using the HTMT method because this measure of discriminant validity is considered more accurate. The recommended threshold value for this method is below 0.900 [55]. The data in Table 3 show that all correlation values between variables are below this threshold. These evaluation results confirm that all measurement items in this study have validly met the criteria for discriminant validity.

[insert] Table 3. HTMT criteria for discriminant validity.

Table 4 presents a summary of the cross-loading test results. These tests showed that OSH.2, OSH.3, SB.6, and MR.8 were weak items; however, it was decided to retain all four items because they contributed to the model's validation. The correlation of the anxiety indicator with the OSH knowledge construct itself was significantly higher than its correlation with other latent constructs. A similar pattern was also found in the job safety analysis variable, where the factor loadings of its indicators were more strongly concentrated on its original construct than on other variables within the model. Estimation results for the variables "Safety Behavior" and "Mitigate Risks" also showed a similar trend of consistent factor loadings. A comprehensive evaluation confirmed that each research indicator had the highest correlation with its target construct. This distribution of values confirms that all measurement items in this study have met the criteria for discriminant validity.

[insert] Table 4. Cross-factor loading

Reliability Test

Table 5 presents a summary of the results of the Cronbach's Alpha, composite reliability, and Dijkstra-Henseler's Rho (rho_A) tests. These internal consistency reliability tests set a minimum threshold of 0.70 for Cronbach's Alpha [56–58]. The minimum threshold for the composite reliability index is 0.70 [59]. The Dijkstra-Henseler's Rho (rho_A) value must also be above 0.70 to obtain the most accurate reliability estimate in PLS-SEM [60].

The findings demonstrate that all measurement items in this study exhibit high reliability. Cronbach's Alpha values exceeding 0.70 indicate that the indicators for each variable possess good internal consistency. This consistency is reinforced by the composite reliability and Dijkstra-Henseler's Rho values, which consistently remained above 0.70. This confirms that the measurement model developed is stable, meaning that the field data collected accurately represent all theoretical concepts of the variables.

[insert] Table 5. Reliability test results

Structure model

Checking for multicollinearity among variables by evaluating the internal Variance Inflation Factor (VIF) is a prerequisite before testing hypotheses in a structural model. The threshold value for detecting multicollinearity is less than 5 [61]. Table 6 presents the detailed results of the multicollinearity test. The estimation results in Table 6 show that all Internal VIF values are below 5. This indicates that

multicollinearity among the variables in this model is low. Methodologically, this finding strengthens the reliability of the parameter estimates in PLS-SEM, ensuring that the results are robust and unbiased.

[insert] Table 6. Multicollinearity Test Results

Hypothesis Testing.

Table 7 presents the results of the hypothesis testing for direct effects, evaluated using path values, t-values, and p-values. Hypothesis testing in this structural model uses a t-value threshold of 1.96 and a significance level of 0.05 at the 95% confidence level.

[insert] Table 7. Direct effects result

The data in Table 7 show that OSH Knowledge has a positive and significant effect on Safety Behavior, thus the first hypothesis (H1) is accepted. The OSH Knowledge variable was also found to have a positive relationship with and a significant contribution to the level of Mitigate Risks, confirming the validity of the second hypothesis (H2). A further positive and significant effect was found in the relationship between Job Safety Analysis and Safety Behavior, thus providing empirical support for the third hypothesis (H3). Path analysis for the fourth hypothesis (H4) also showed that Job Safety Analysis has a positive and significant effect on Mitigate Risks. The final relationship path revealed a significant positive influence of Safety Behavior on Mitigate Risks, thus the fifth hypothesis (H5) was accepted.

The hypothesis of mediation effect testing

Table 8 presents a summary of the results of the indirect effects hypothesis tests to evaluate the mediating role within the structural model. Table 8 shows that the Safety Behavior variable successfully mediates the relationships between OSH Knowledge and Mitigate Risks, as well as between Job Safety Analysis and Mitigate Risks. The successful mediation in both pathways confirms that the sixth (H6) and seventh (H7) hypotheses are empirically supported.

[insert] Table 8. Indirect effects result

Results of the model produced by the SmartPLS program.

The structural path diagram in Figure 3 presents the model estimates obtained through the bootstrapping procedure, with particular emphasis on the T-statistic values. The test results show that all estimated path coefficients are well above the critical threshold of 1.96. This provides absolute empirical evidence that all direct-effect hypotheses in the research model are accepted at the 95% confidence level. Analysis of the outer model reveals that all manifest indicators exhibit highly significant loadings on their respective latent variables. This phenomenon confirms the fundamental insight that each item in the questionnaire was consistently interpreted by culinary students as a true representation of safety activities in the practice kitchen. This pattern of consistent and strong significance provides a valid methodological foundation for testing the mediation hypothesis regarding Safety Behavior and ensures the model's structural stability when applied to a broader test sample.

[insert] Fig 3. Structural model

The data in Table 9 present the results of the R-squared coefficient of determination test, which measures the model's ability to explain variance in the structural model. The results indicate that 30.3% of the variance in the Safety Behavior variable is explained by its predictor variables, which falls within the "moderate" interpretation category. The explanatory power of the structural model increased significantly in the final path, with the R-squared value for the Mitigate Risks construct reaching 54.3%. This phenomenon confirms the operational insight that the comprehensive integration of mastery of occupational safety theory, compliance with Job Safety Analysis documents, and articulation of students' safe behaviors collectively is highly effective in minimizing the potential for workplace accidents in the kitchen. The Adjusted R-squared value, which consistently moves in the same direction as the main R-squared value, further demonstrates that the developed structural model exhibits good predictive stability and is free from variable specification bias.

[insert] Table 9. R-square test results

The data in Table 10 present the results of the PLS-predict test evaluating the predictive power of the built structural model. The calculation results show that all indicators in the Mitigate Risks and Safety Behavior constructs consistently yield negative delta values. This finding demonstrates that the prediction error of the PLS-SEM model is significantly lower than that of the linear model, thereby indicating that this research model has high predictive power. The PLS-SEM model's superiority over the linear model across all measurement items indicates the presence of complex, non-linear behavioral interactions within the culinary students' laboratory kitchen

ecosystem. The fact that all Q^2 predict values are above the zero threshold further confirms that this structural model is free of overfitting. This finding provides strong methodological legitimacy that the set of safety intervention instruments based on Job Safety Analysis in this study has stable and valid predictive accuracy for application to a broader population of culinary students or vocational institutions in the real world.

[insert] Table 10. PLS-predict Results for Target Construct Indicators

Discussion

The research findings confirm that OHS Knowledge has a positive and significant influence on students' safety behavior in the culinary laboratory. These findings suggest that mastery of the theoretical cognitive aspects of occupational safety regulations serves as a foundation for students' understanding of the essence behind every safety measure they must take during laboratory sessions [11]. This finding is highly relevant to cognitive competence, as it demonstrates that theoretical knowledge is the primary foundation for reducing the likelihood of human error in the workplace [5]. This positive impact is supported by a literature review [37], which, like the current study, finds that a high level of safety literacy consistently underpins an individual's discipline in adhering to daily workplace safety protocols.

Path analysis shows that Job Safety Analysis has a highly dominant positive influence on the formation of safety behavior. These results provide operational insights into a dynamic and fast-paced practical work environment. Students' safety behavior is more effectively prompted by practical tools such as completing hazard identification sheets immediately before work than by abstract theoretical understanding [19,43]. This finding makes a significant contribution to Behavior-Based Safety by specifically demonstrating that environmental conditioning through structured administrative procedures is the strongest stimulus in guiding individuals' safe actions in the field [25,27]. These results are consistent with a previous study [23], which also found that daily safety checklists are far more effective in intervening in risky work habits in operational areas. Establishing structured procedures aimed at fostering a culture of safety in the workplace from the very beginning during the training phase designed to prepare students for their professional careers is one approach to supporting the SDG of decent work and economic growth.

Test results show that OHS Knowledge makes a significant and direct positive contribution to the level of risk mitigation. The real-world implications of these findings suggest that when students are equipped with a solid understanding of OSH, they are not only able to work safely but also possess the analytical acumen to identify, isolate, and minimize potential latent hazards in kitchen settings [9,11]. The relevance of these findings to Protection Motivation Theory lies in the threat appraisal aspect, where this study empirically demonstrates that adequate cognitive understanding significantly enhances an individual's motivation to take self-protective actions against

environmental hazards [5,36,37]. This effect is reinforced by the findings [62], who in a similar laboratory setting, concluded that mastery of safety theory linearly increases the accuracy of emergency decision-making during workplace accidents.

The subsequent causal relationship demonstrates that Job Safety Analysis has a direct, positive, and significant influence on the effectiveness of risk mitigation. This finding confirms that the Job Safety Analysis document is not merely an administrative formality at the beginning of the practicum but rather a risk-control tool that effectively maps out practical hazard-prevention measures for students before accidents occur [12,13]. This finding is highly relevant to the principle of “reluctance to simplify” because it specifically demonstrates that a detailed identification of potential hazards through a Job Safety Analysis can substantially mitigate systemic operational risks [43]. These impact characteristics are supported by the findings [11], which show similarities to the current study: the standardization of document-based job safety analysis proved effective in mitigating physical injury incidents in technical work environments.

The results of the structural model estimation confirm that safety behavior is the strongest direct determinant of risk mitigation success. These results reinforce real-world insights that even ideal safety regulations and high levels of documentation compliance cannot reduce workplace accident rates on their own, without tangible, physical preventive actions taken by practitioners during the cooking process [13]. The relevance of these findings lies in reinforcing the role of internal attribution, as this study empirically demonstrates that personal behavioral control is the primary anchor that translates understanding into tangible risk-mitigation outcomes in the field [2,20]. These results are fully supported by the findings [63,64], whose research in high-risk work environments also concluded that active individual behavior is the ultimate determinant of the effectiveness of an organization’s risk management system.

The results of the study indicate that safety behavior positively and significantly mediates the relationship between OHS knowledge and risk mitigation. The nature of mediation in this pathway is categorized as partial mediation because the direct effects observed in previous tests were also statistically significant. This finding provides a scientific explanation that mastery of theoretical material regarding latent laboratory hazards is insufficient to create real risk mitigation in the laboratory kitchen area [19]. Therefore, students need to engage in physical practice specifically by first developing the habit of safe actions so that risk mitigation can function optimally [13].

Cognitive knowledge regarding the flash point of cooking oil or the dangers of bacterial cross-contamination does not automatically mitigate the risk of fire or food poisoning in the context of culinary students’ laboratory activities. Such knowledge merely serves as an awareness trigger [65]. OSH knowledge is only effective in reducing accident rates if students consciously practice safe behaviors in the culinary laboratory. Examples of these safe practices include promptly turning down the heat when oil begins to smoke or consistently separating meat knives from vegetable knives during food preparation [39].

This study specifically demonstrates that self-protection motivation grounded in cognitive knowledge requires concrete actions to significantly reduce potential environmental hazards [11,35,36]. This theoretical contribution strengthens the extension of Behavior-Based Safety theory in culinary education settings by demonstrating the significance of active behavior in converting knowledge into protective outcomes [17,25]. Furthermore, these significant mediation results align with previous research [39], which shares a similar context with the current study. Both studies confirm that a high level of workplace safety literacy does not provide an immediate protective effect in dynamic operational settings until it is manifested through consistent adherence to daily work procedures by practitioners.

The results of this study confirm that safety behavior plays a strong partial mediating role in the relationship between Job Safety Analysis and risk mitigation. This finding reveals a fundamental operational insight within culinary laboratories: that tactical administrative tools, such as completing Job Safety Analysis forms, are more effective at triggering students' safety reflexes than theoretical knowledge interventions [19]. Based on this, the results of this analysis address the research problem regarding the failure to prevent accidents caused by human error in kitchen settings [5]. Shaping the work environment through the Job Safety Analysis worksheet tangibly guides culinary students to immediately identify hazards [13] in the culinary laboratory just before handling cooking equipment.

Culinary arts students need practical guidance integrated into their daily activities, especially when dealing with the realities of a training kitchen characterized by a fast-paced, noisy work environment and time pressure [5]. The routine of filling out a Job Safety Analysis form before cooking trains students to engage in situational reflection. As a result, awareness of these hazards is immediately applied to preventive actions in the real world. Examples include ensuring the floor around the deep-frying area remains dry, keeping dishcloths out of reach of the stove flame, and turning the handles of hot pots inward to prevent them from being knocked over. These physical actions ultimately serve as the primary means of reducing the risk of burns, slips, and other injuries in the culinary laborator [44]. Safety practices in the operational kitchen environment can protect students' physical health and well-being, in line with the SDG related to good health and well-being, by reducing physical injuries.

Quantitative evidence shows that unsafe practices in the field can be curbed through daily workplace hazard analysis documents, which serve as an effective stimulus [12]. The value of this mediation coefficient indicates that fostering a safety culture in culinary vocational institutions must be driven by a systematic approach that integrates students' daily operational activities, rather than by formal appeals alone. Furthermore, these findings align with and reinforce the results of a previous study [11], which concluded that the standardization of pre-work, document-based hazard analysis is highly effective in converting regulatory compliance into a substantial reduction in workplace accident rates through the mediation of safe work habit formation.

The findings of this structural model make a significant practical contribution by repositioning the paradigm of safety interventions in culinary laboratories, shifting it from a cognitive-passive approach to an active-operational one. This paradigm shift supports the achievement of the SDG on Quality Education by providing culinary vocational training that equips students with practical safety skills. The results of this study have shifted the focus of university policy away from simply increasing the number of OSH theory lecture hours and toward the mandatory implementation of standardized tactical routines, specifically the completion of a digital Job Safety Analysis form fifteen minutes before the start of practical sessions. This practical contribution also serves as a new evaluation tool for program administrators to incorporate student safety behavior components such as the complete use of personal protective equipment and the proper handling of hot waste as mandatory and binding components of daily assessments.

The formulation of this model has also successfully addressed the root cause of the research problem regarding the persistently high rate of minor workplace injuries in the lab kitchen, even though students have completed occupational safety courses. This knowledge-behavior gap phenomenon is empirically explained by the fact that mastery of abstract theoretical material alone cannot reduce the risk of accidents without an operational bridge in the field [42]. The Job Safety Analysis serves as a structural anchor that compels students to apply their general knowledge of occupational safety and health to identify contextual hazards at their workstations, thereby establishing a continuous preventive process that translates their understanding into tangible risk mitigation.

Conclusion

This study aims to explore the direct and indirect effects of OSH Knowledge, Job Safety Analysis, and Safety Behavior on Risk Mitigation among culinary students in the culinary laboratory. The findings of this study indicate that OSH Knowledge positively affects Safety Behavior and Risk Mitigation in the culinary laboratory. On the other hand, Job Safety Analysis was found to influence Safety Behavior and have a significant impact on Risk Mitigation in culinary laboratories. Similarly, Safety Behavior was shown to positively influence Risk Mitigation. Meanwhile, in the analysis of indirect effects, Safety Behavior successfully mediated the relationship between OSH Knowledge and Job Safety Analysis on Risk Mitigation.

This research successfully and definitively answered all research questions regarding the factors that drive workplace safety in culinary laboratories. These questions were answered by demonstrating that the integration of an understanding of safety regulations and the daily application of hazard analysis can linearly foster tangible preventive actions among students. The key finding is that tactical routines such as filling out hazard analysis sheets at workstations are a far stronger driver of building safe behavioral reflexes in the culinary lab than merely mastering abstract OSH theory. The habit of safe actions serves as an operational anchor that translates

students' understanding into success in minimizing physical workplace accidents , such as burns or cuts during cooking. Substantively, this study implies that workplace safety in a laboratory kitchen environment is not determined by how many rules are memorized, but rather by the discipline of implementing small preventive measures before cooking begins. Preventing physical workplace accidents through the consistent practice of disciplined preventive measures supports the SDG of Good Health and Well-being by ensuring a safe learning environment for student interns.

This study offers several important implications. First, these findings successfully expand the scope of Behavior-Based Safety theory by empirically demonstrating that the formation of safe behavior in dynamic, high-risk environments requires tactical administrative bridges, rather than relying solely on cognitive understanding. Second, this paper can serve as a reference for policymakers in culinary arts departments to update existing systems. Culinary arts departments can no longer rely on conventional methods that merely emphasize adding more hours of occupational safety and health theory in the classroom. Institutions must reform their pre-practicum standard operating procedures to require completion of Job Safety Analysis forms. Through this curriculum reform, vocational education institutions are making a tangible contribution to the achievement of SDG 3, SDG 4, and SDG 8 by equipping future culinary industry professionals with sustainable safety competencies.

Limitation

This study candidly acknowledges specific limitations related to the narrow scope of the sample, which focused solely on culinary arts students at a single vocational institution, and the use of a self-report method in the questionnaire. These limitations have direct implications for the generalizability of the results, meaning that these findings cannot be directly applied to large-scale commercial culinary industries or geographic regions with different regulatory standards. Furthermore, the limitations of the self-report method may restrict the depth of analysis due to social desirability bias among respondents when assessing their own safety behaviors. These limitations open the door for future researchers to expand the model's scope of generalization through direct observation approaches and by involving multiple vocational institutions across Indonesia.

Future Research

A major conceptual gap that remains unaddressed in this study is the neglect of the influence of different organizational safety climates, given that this research is limited to an academic environment characterized by high error tolerance and a nonprofit orientation. Future research should employ a cross-sectoral comparative study by applying this model to commercial kitchens, such as those in five-star hotels or mass-catering airlines, which face high employee turnover and strict financial penalties. This approach is crucial because safety regulations in the commercial sector

are driven by legal compliance and economic productivity, not merely academic assessments. The expected findings will identify the extent to which this model's structural stability can withstand the demands of business profitability, thereby enriching risk management's understanding of the effectiveness of transferring OSH competencies from the educational realm to the real-world industrial setting.

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Data availability

The datasets generated and/or analyzed during this study are not publicly available due to ethical considerations regarding the protection of participant identities, but are available from the corresponding author upon reasonable request.

Author contributions

SH (corresponding author) conceived and designed the study, supervised the research, secured funding, and critically reviewed and edited the manuscript. **MGM** conducted the investigation, administered the project, collected and curated the data, performed the formal analysis, interpreted the findings, and drafted the manuscript. **LTP** contributed to the research methodology, validated the results, critically revised the manuscript, and interpreted the findings. **AN** contributed to the study design, reviewed and edited the manuscript, and approved the final version. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Declarations

Ethics approval

The study protocol was exempted from formal ethical review by the Institutional Review Board (IRB) of Universitas Negeri Surabaya because the research was conducted in an educational setting and involved standard educational practices, posing minimal to no risk to the participants.

Ethical compliance

This study was conducted in accordance with the ethical guidelines and regulations of the Declaration of Helsinki.

Consent to participate

Participation in this study was entirely voluntary. Informed consent was obtained from all individual participants prior to data collection. Data confidentiality and anonymity were strictly maintained, and no personally identifiable information is included in the dataset.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Clinical trial number

Not applicable.

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Table

Table 1. Outer loading of dan AVE results.

Variable	Item	Outer loading	AVE
OSH knowledge	OSH.1	0.768	0.538
	OSH.2	0.686	
	OSH.3	0.657	
	OSH.4	0.797	
	OSH.5	0.773	
	OSH.6	0.709	
Job safety analysis	JSA.1	0.752	0.597
	JSA.2	0.748	
	JSA.3	0.745	
	JSA.4	0.803	
	JSA.5	0.788	
	JSA.6	0.798	
Safety behavior	SB.1	0.761	0.570
	SB.2	0.763	
	SB.3	0.763	
	SB.4	0.717	
	SB.5	0.829	
	SB.6	0.690	
Mitigate risks	MR.1	0.773	0.545
	MR.2	0.760	
	MR.3	0.760	
	MR.4	0.708	
	MR.5	0.714	
	MR.6	0.737	
	MR.7	0.749	
	MR.8	0.698	

Table 2. Fornell and Lacker's criteria for discriminant validity.

	Job safety analysis	Mitigate risks	OSH knowledge	Safety behavior
Job safety analysis	0.773			
Mitigate risks	0.477	0.738		
OSH knowledge	0.003	0.427	0.733	
Safety behavior	0.476	0.651	0.278	0.755

Table 3. HTMT criteria for discriminant validity.

	Job safety analysis	Mitigate risks	OSH knowledge	Safety behavior
Job safety analysis				
Mitigate risks	0.536			
OSH knowledge	0.110	0.493		
Safety behavior	0.546	0.741	0.330	

Table 4. Cross-factor loading

Item	Job safety analysis	Mitigate risks	OSH knowledge	Safety behavior
J.1	0.752	0.305	-0.034	0.302
J.2	0.748	0.308	-0.011	0.359
J.3	0.745	0.383	0.073	0.322
J.4	0.803	0.430	-0.019	0.401
J.5	0.788	0.393	-0.005	0.424
J.6	0.798	0.371	0.009	0.377
M.1	0.445	0.773	0.336	0.591
M.2	0.262	0.760	0.358	0.472
M.3	0.349	0.760	0.365	0.471
M.4	0.327	0.708	0.291	0.359
M.5	0.375	0.714	0.192	0.480
M.6	0.466	0.737	0.281	0.466
M.7	0.306	0.749	0.339	0.492
M.8	0.261	0.698	0.347	0.475
O.1	0.062	0.381	0.768	0.164
O.2	-0.038	0.253	0.686	0.176
O.3	0.037	0.294	0.657	0.196
O.4	-0.122	0.302	0.797	0.236
O.5	0.043	0.282	0.773	0.216
O.6	0.023	0.343	0.709	0.232
SB.1	0.348	0.473	0.228	0.761
SB.2	0.318	0.493	0.209	0.763
SB.3	0.400	0.557	0.259	0.763
SB.4	0.370	0.466	0.143	0.717
SB.5	0.414	0.536	0.196	0.829
SB.6	0.286	0.400	0.220	0.690

Table 5. Reliability test results

Variabel	Cronbach' s Alpha	Composite Reliability	Dijkstra-Henseler's Rho
OHS Knowledge	0.827	0.831	0.874
Job Safety Analysis	0.865	0.871	0.899
Safety Behavior	0.848	0.854	0.888
Mitigate Risks	0.881	0.884	0.905

Table 6. Multicollinearity Test Results

	Job safety analysis	Mitigate risks	OSH knowledge	Safety behavior
Job safety analysis		1.323		1.000
Mitigate risks				
OSH knowledge		1.110		1.000
Safety behavior		1.434		

Table 7. Direct effects result

Hypothesis	Path value	Std. dev	t value	p value	Decision
OHS Knowledge → Safety Behavior	0.277	0.076	3.645	0.000	Accepted
OHS Knowledge → Mitigate Risks	0.303	0.068	4.454	0.000	Accepted
Job Safety Analysis → Safety Behavior	0.475	0.074	6.405	0.000	Accepted
Job Safety Analysis → Mitigate Risks	0.267	0.078	3.436	0.001	Accepted
Safety Behavior → Mitigate Risks	0.439	0.076	5.805	0.000	Accepted

Table 8. Indirect effects result

Hypothesis	Path value	Std. dev	t value	p value	Decision
OHS Knowledge → Safety Behavior → Mitigate Risks	0.121	0.044	2.779	0.006	Accepted
Job Safety Analysis → Safety Behavior → Mitigate Risks	0.208	0.052	4.022	0.000	Accepted

Table 9. R-square test results

Pathway	Variable	R-square	Square adjusted
I	Safety Behavior	0.303	0.291
II	Mitigate Risks	0.543	0.531

Table 10. PLS-predict Results for Target Construct Indicators

Latent construct	Items	PLS-SEM	Linear Model	Δ	Q ² Predict
Mitigate risks	MR.1	0.488	0.510	-0.022	0.273
	MR.2	0.537	0.561	-0.024	0.160
	MR.3	0.556	0.596	-0.04	0.222
	MR.4	0.531	0.556	-0.025	0.166
	MR.5	0.540	0.585	-0.045	0.137
	MR.6	0.503	0.541	-0.038	0.252
	MR.7	0.500	0.523	-0.023	0.174
	MR.8	0.594	0.634	-0.040	0.159
Safety Behavior	SB.1	0.556	0.594	-0.038	0.143
	SB.2	0.585	0.616	-0.031	0.116
	SB.3	0.534	0.562	-0.028	0.196
	SB.4	0.622	0.659	-0.037	0.132
	SB.5	0.574	0.600	-0.026	0.181
	SB.6	0.523	0.535	-0.012	0.107

Figure



Fig 1. Conceptual Research Model

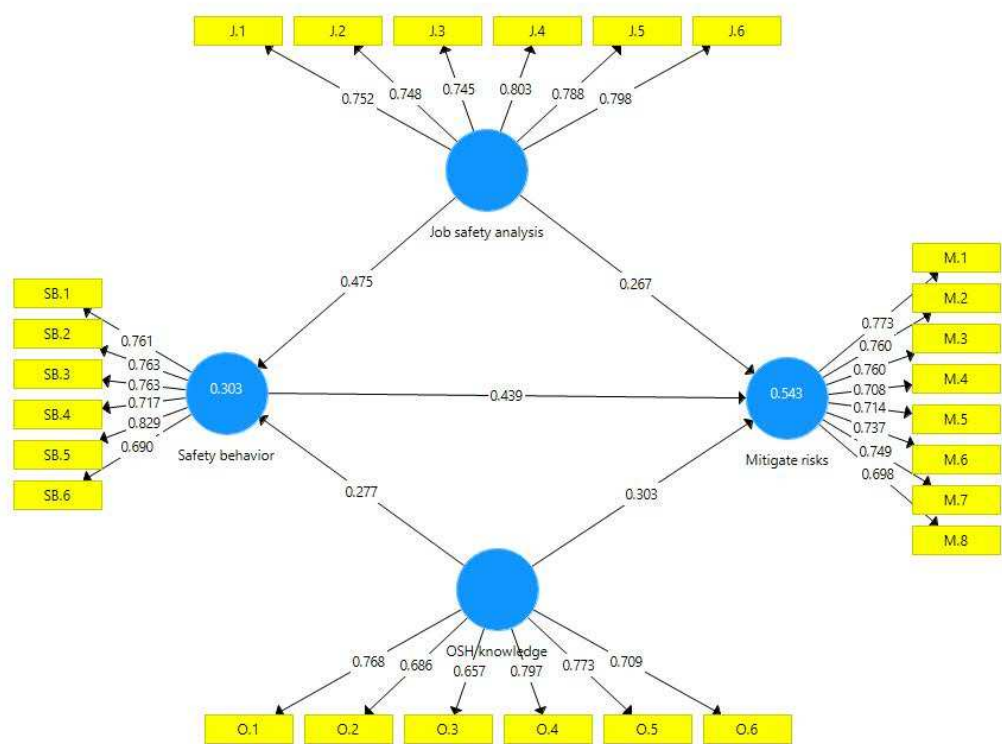


Fig 2. Convergent validity

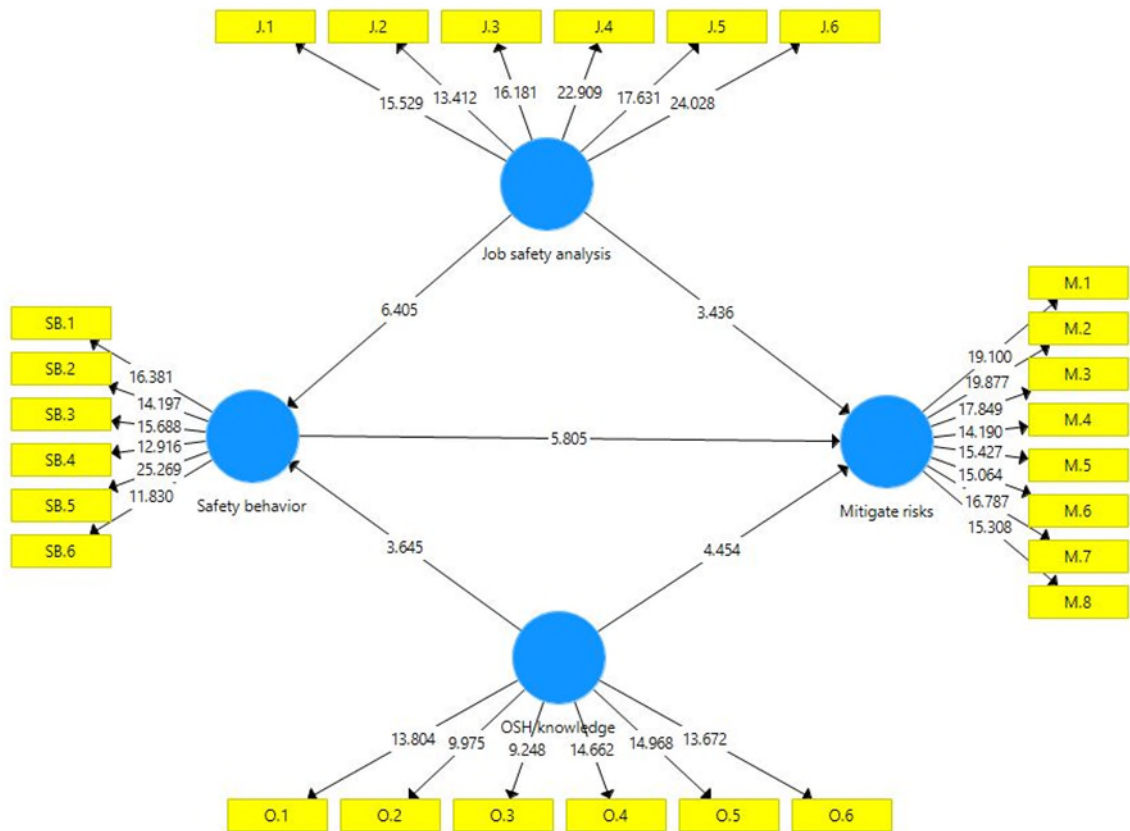


Fig 3. Structural model