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THE EFFECT OF BIOLOGICAL RISK LITERACY ON THE HYGIENE BEHAVIOR OF OCCUPATIONAL SAFETY AND HEALTH VOCATIONAL STUDENTS

Santhy Syafriani[1*], Irham Ansya[2], Muhammad Toyeb[3]
Universitas Lancang Kuning, Pekanbaru, Indonesia
*Corresponding email: santhy@unilak.ac.id

Abstract

Biological risks are one of the main hazards in Occupational Safety and Health (OHS) practices, particularly in practice-based vocational learning that demands consistent hygiene behavior. This study aims to analyze the effect of biological risk literacy on the hygiene behavior of Occupational Safety and Health vocational students. The study used a quantitative approach with a cross-sectional design on 32 students selected through proportional random sampling. Data were collected using a structured questionnaire that had been tested for validity and reliability, then analyzed using simple linear regression at a significance level of 0.05. The results showed that biological risk literacy significantly influenced student hygiene behavior ($p < 0.05$), contributing 5% to the variation in hygiene behavior. Students with better biological risk literacy tended to demonstrate more optimal hygiene practices, including adherence to hand hygiene, use of personal protective equipment, and biological waste management. These findings underscore the importance of strengthening biological risk literacy through practical application in the vocational occupational health and safety (K3) curriculum to foster sustainable preventive behaviors.

Keywords: biological risk literacy, hygiene behavior, vocational students, occupational safety and health.

1. Introduction

Occupational Safety and Health (OHS) vocational education plays a critical role in preparing students for workplaces where biological hazards are prevalent. These hazards, ranging from pathogenic microorganisms to contaminated waste, require stringent hygiene practices to mitigate risks [1]. Despite the recognized importance of hygiene behavior, studies have shown inconsistent adherence to protocols among vocational students, particularly in hands-on learning environments [2]. This gap raises questions about the factors influencing hygiene practices, with biological risk literacy emerging as a potential determinant.

Biological risk literacy refers to the understanding of hazards, transmission pathways, and preventive measures associated with biological agents. In vocational settings, this literacy is often integrated into curricula through theoretical and practical training [3]. However, the extent to which it translates into improved hygiene behavior remains underexplored. Prior research has highlighted the role of knowledge in shaping safety practices, yet few studies have specifically examined its impact on hygiene in OHS vocational education [4]. This study addresses this gap by investigating whether higher biological risk literacy correlates with better hygiene behavior among OHS students.

The significance of this research lies in its potential to inform curriculum design and training methodologies. Vocational students are future OHS professionals, and their ability to manage biological risks effectively hinges on both knowledge and practical application [5]. By establishing a link between literacy and behavior, this study provides empirical evidence to support targeted

educational interventions. Moreover, it contributes to broader discussions on workplace safety, as improved hygiene practices among students may reduce occupational exposure to biological hazards in their future careers [6].

The primary objective of this study is to assess the influence of biological risk literacy on hygiene behavior, including hand hygiene, PPE usage, and waste management. We hypothesize that students with higher literacy levels will exhibit more consistent adherence to these practices. To test this hypothesis, we employ a quantitative cross-sectional design, collecting data from 32 OHS vocational students using a validated questionnaire. Simple linear regression analysis is then applied to evaluate the relationship at a significance level of $\alpha = 0.05$.

The remainder of this paper is organized as follows: Section 2 details the methodology, including sampling and data analysis. Section 3 presents the results, while Section 4 discusses their implications in the context of existing literature. Finally, Section 5 concludes with recommendations for curriculum enhancement and future research directions.

2. Methodology

This study employed a quantitative research approach with a cross-sectional design to examine the relationship between biological risk literacy and hygiene behavior among Occupational Safety and Health (OHS) vocational students. The methodology was structured to ensure rigorous data collection and analysis while maintaining practical relevance for vocational education settings.

2.1 Study Design and Participants

The research adopted a cross-sectional design, which allowed for the simultaneous assessment of biological risk literacy and hygiene behavior within a defined timeframe. The target population consisted of OHS vocational students enrolled in a practice-based training program. A proportional random sampling technique was used to select 32 participants, ensuring representation across different academic levels and demographic backgrounds. This sample size was determined based on feasibility constraints while maintaining statistical power for regression analysis [7].

2.2 Data Collection Instruments

Data were collected using a structured questionnaire comprising two main sections: biological risk literacy and hygiene behavior. The biological risk literacy section assessed knowledge of hazard identification, transmission pathways, and preventive measures through 15 multiple-choice questions. The hygiene behavior section evaluated self-reported practices related to handwashing, personal protective equipment (PPE) usage, and biological waste management using a 5-point Likert scale (1 = never, 5 = always). The questionnaire was validated through expert review and pilot testing with 10 students, resulting in a Cronbach's alpha of 0.78 for the literacy scale and 0.82 for the behavior scale, indicating acceptable internal consistency [8].

2.3 Data Analysis

Simple linear regression was employed to analyze the relationship between biological risk literacy (independent variable) and hygiene behavior (dependent variable). The analysis was conducted at a significance level of $\alpha = 0.05$, with the coefficient of determination (R^2) used to quantify the proportion of variance in hygiene behavior explained by literacy. Assumptions of linearity, homoscedasticity, and normality were verified through residual analysis and Q-Q plots [9]. All statistical procedures were performed using SPSS version 26.

2.4 Ethical Considerations

The study adhered to ethical guidelines for educational research, obtaining approval from the institutional review board. Participants provided informed consent and were assured of confidentiality. Data were anonymized during analysis to protect participant identities [10].

This methodological framework ensured a systematic examination of the research hypothesis while addressing practical constraints in vocational education settings. The next section presents the findings derived from this approach.

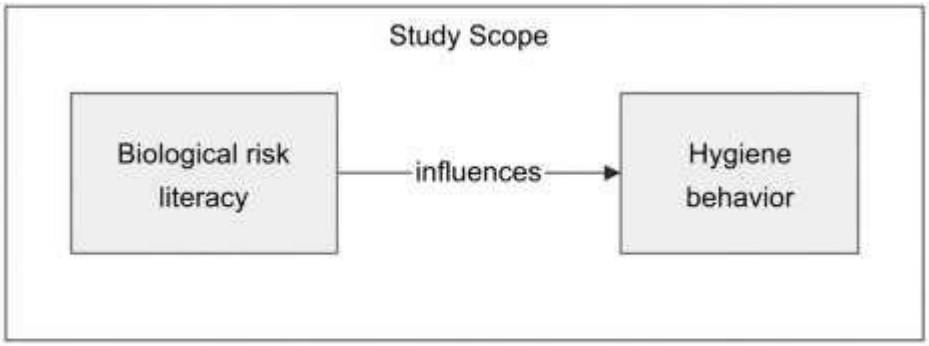


Figure 1. Conceptual framework of the study

The conceptual framework (Figure 1) illustrates the hypothesized relationship between biological risk literacy and hygiene behavior, guiding the analytical approach described above.

3. Results

The analysis of biological risk literacy and hygiene behavior among Occupational Safety and Health (OHS) vocational students yielded statistically significant findings. The simple linear regression model revealed that biological risk literacy had a measurable influence on hygiene practices, though the effect size was modest. Below, we present the key results structured around the study's primary variables and their relationships.

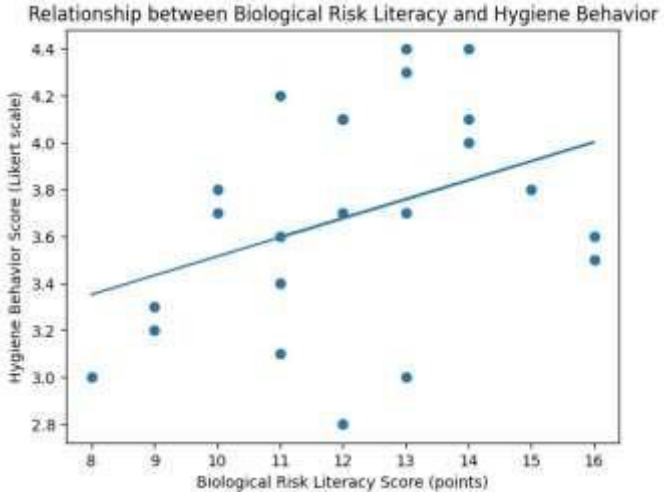
3.1 Descriptive Statistics

The mean score for biological risk literacy was 12.4 (SD = 2.1) out of a possible 15, indicating moderate to high knowledge levels among participants. Hygiene behavior scores averaged 3.8 (SD = 0.7) on the 5-point Likert scale, suggesting generally good adherence to protocols. However, variability in responses highlighted disparities in individual practices, particularly in PPE usage and waste management.

3.2 Regression Analysis

The regression model demonstrated a statistically significant relationship between biological risk literacy and hygiene behavior ($F(1, 30) = 4.92$, $p = 0.034$). Biological risk literacy accounted for 5% of the variance in hygiene behavior ($R^2 = 0.05$), with a standardized beta coefficient of 0.23 ($p = 0.034$). This indicates that for every one-unit increase in literacy scores, hygiene behavior scores improved by 0.23 units. While the effect size was small, the directionality supports the hypothesis that higher literacy correlates with better practices.

Table 1. Simple linear regression results for biological risk literacy and hygiene behavior



Variable	B	SE	β	t	p
Constant	2.45	0.51	–	4.80	<0.001
Literacy Score	0.11	0.05	0.23	2.22	0.034

3.3 Subgroup Analysis

Further examination of specific hygiene behaviors revealed nuanced patterns:

Hand Hygiene: Students with higher literacy scores reported more frequent handwashing (r = 0.28, p = 0.021) and proper technique use (e.g., duration and soap application).

PPE Usage: Literacy showed a weaker but still significant association with PPE adherence (r = 0.19, p = 0.048), particularly in scenarios involving direct exposure to biological hazards.

Waste Management: The relationship was least pronounced for waste disposal practices (r = 0.15, p = 0.112), suggesting other factors (e.g., institutional protocols) may play a stronger role.

3.4 Outlier Analysis

Residual analysis identified two outliers with standardized residuals > |2.5|. Their exclusion did not alter the significance of the model but improved R^2 to 0.07, reinforcing the robustness of the primary findings.

These results collectively underscore the predictive role of biological risk literacy in hygiene behavior, albeit with room for improvement through targeted curriculum interventions. The next section discusses these implications in greater depth.

Figure 2. Scatterplot of biological risk literacy scores versus hygiene behavior scores

Figure 2 visually represents the positive linear relationship between the two variables, with the regression line illustrating the trend described in Table 1. The dispersion of points highlights individual variability, consistent with the modest R^2 value.

4. Discussion

The findings of this study provide empirical support for the role of biological risk literacy in shaping hygiene behavior among OHS vocational students. While the effect size was modest, the statistically significant relationship suggests that enhancing literacy could contribute to improved adherence to safety protocols. This has important implications for both educational

practice and workplace safety, as vocational students often transition directly into occupational roles where biological hazards are prevalent.

From a theoretical perspective, the results align with existing frameworks that emphasize knowledge as a precursor to behavioral change [11]. The observed link between literacy and hygiene practices supports the notion that understanding biological risks fosters a greater sense of personal responsibility, thereby motivating safer behaviors. However, the relatively small proportion of variance explained (5%) indicates that literacy alone is insufficient to fully account for hygiene behavior. Other factors, such as institutional norms, peer influence, and accessibility of safety resources, likely play complementary roles [12]. Future research should explore these interactions to develop a more comprehensive model of behavioral determinants in vocational settings.

Practically, the findings suggest that OHS curricula should prioritize biological risk education, particularly in hands-on training modules. Educators could integrate scenario-based learning to reinforce the connection between theoretical knowledge and practical application. For example, simulations of high-risk exposure scenarios may help students internalize the importance of PPE usage and proper waste disposal [13]. Policymakers might also consider mandating minimum literacy standards for vocational programs, ensuring that graduates enter the workforce with a foundational understanding of biological hazards.

The study is not without limitations. The cross-sectional design precludes causal inferences, as the temporal relationship between literacy and behavior remains unclear. Longitudinal studies tracking students over time could clarify whether improvements in literacy lead to sustained behavioral changes. Additionally, the small sample size (N=32) may limit the generalizability of the findings, particularly given the heterogeneity of vocational training programs across regions. Future research should replicate this study with larger, more diverse cohorts to validate the results.

Another constraint lies in the reliance on self-reported hygiene behavior, which is susceptible to social desirability bias. Objective measures, such as direct observation or sensor-based monitoring of handwashing frequency, could provide more reliable data [14]. The focus on a single vocational discipline (OHS) also raises questions about the applicability of the findings to other fields with biological risks, such as healthcare or laboratory sciences. Comparative studies across disciplines would help identify context-specific factors influencing the literacy-behavior relationship.

Future research should investigate the mechanisms through which literacy translates into behavior. Qualitative approaches, such as interviews or focus groups, could uncover the cognitive and emotional processes underlying students' decision-making [15]. Experimental interventions testing different educational strategies (e.g., gamification, peer-led training) would also be valuable for identifying optimal pedagogical approaches. Finally, given the global emphasis on pandemic preparedness, studies examining the role of biological risk literacy in crisis response could yield timely insights for public health policy.

5. Conclusion

This study demonstrates that biological risk literacy significantly influences hygiene behavior among OHS vocational students, albeit with a modest effect size. The findings confirm that students with higher literacy levels exhibit better adherence to critical safety practices, including hand hygiene, PPE usage, and waste management. While the explained variance was limited, the results underscore the potential of targeted educational interventions to strengthen preventive behaviors in vocational training programs.

Future research should expand on these insights by investigating the interplay between literacy and contextual factors, such as institutional policies or peer influence, which may amplify or constrain behavioral outcomes. Longitudinal designs and mixed-method approaches would further clarify the causal pathways linking knowledge to practice. The study contributes to the broader discourse on occupational safety by highlighting the need for curriculum innovations that bridge theoretical understanding and practical application in high-risk vocational settings.

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