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Analysis of factors influencing personal protective equipment use behavior among students in vocational high school engineering workshops

Renjistian Viga Vidariatma[1], Suherman[2], Triana Srisantyorini[3], Januar Ariyanto[4]
[1,2,3,4]Department of Public Health, Faculty of Public Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia

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ABSTRACT

Background: The behavior of using Personal Protective Equipment (PPE) among technical workshop students plays an important role in preventing workplace accidents and injury risks during practical activities. However, students' compliance levels in using PPE vary and are influenced by various individual and environmental factors. Purpose: To analyze the factors influencing PPE usage behavior among students in the Technical Workshop of Vocational High School. Methods: This study used a quantitative approach with a cross-sectional design. The population consisted of 1,981 students, with a sample of 205 students selected using stratified random sampling. Data were collected using validated and reliable questionnaires, as well as primary and secondary data sources. The analyses conducted included univariate, bivariate, and multivariate analyses. Results: The results showed that 39.5% of students demonstrated compliant PPE usage behavior, while 60.5% were non-compliant. Bivariate analysis indicated significant relationships between attitude (p-value = 0.016; OR = 0.016) and motivation (p-value = 0.008; OR = 0.008) with PPE usage behavior. No significant relationship was found between knowledge (p-value = 0.644), PPE availability (p-value = 0.113), training (p-value = 0.537), supervision (p-value = 1.00), and peer influence (p-value = 0.570) with PPE usage behavior. Multivariate analysis showed that motivation (p-value = 0.006 < 0.05) was the most influential variable affecting PPE usage behavior among students in the workshop (OR = 2.381). Conclusion: Motivation is the dominant factor influencing PPE usage behavior among workshop students.

Corresponding Author:

Renjistian Viga Vidariatma,
Department of Public Health,
Faculty of public Health,
Universitas Muhammadiyah Jakarta,
Jl. K.H. Ahmad Dahlan, Cireundeu, Kec. Ciputat, Kota Tangerang Selatan, Banten, 15419, Indonesia
Email: renjistianviga@gmail.com

INTRODUCTION

Occupational safety is a series of efforts aimed at creating a safe and secure working environment. Occupational health is a field of health science that aims to ensure workers achieve good physical, mental, and social well-being through preventive and curative measures against diseases or disorders caused by work, the work environment, as well as general illnesses (Suma'mur 2014). Occupational Safety and Health (OSH) is an important aspect in the industrial world. OSH education can be implemented in schools, particularly at vocational education levels such as Vocational High Schools, which aim to produce prospective workers who are competent in their respective fields. As one of the institutions that prepare the workforce, vocational high schools are expected to produce graduates who meet the expectations of the world of work and industry, possessing not only technical skills but also the ability to properly implement occupational safety and health practices. Workplace accidents can be caused by unsafe behaviors, such as not using personal protective equipment (PPE), not working according to procedures, joking or playing around while working, as well as improper placement of tools and incorrect working methods. In addition, unsafe environmental factors such as ineffective machine and equipment conditions, inadequate lighting, unsuitable workspace conditions, noise, and unsafe working floors also increase the risk of workplace accidents (Hadi, Ruliati, and Salmun 2023).

Meanwhile, the number of vocational high school students has also increased, although not as much as general senior high schools, with a total reaching 4,982,768 students. This reflects that interest in vocational education remains relatively high (Kementerian Pendidikan Dan Kebudayaan 2024). The implementation of Occupational Safety and Health (OSH) can be assessed through five variables: attitude, the use of personal protective equipment (PPE), workplace environmental conditions, the use of equipment according to standard operating procedures (SOP), and the implementation of the work culture. When these variables are not properly considered, workplace accidents may occur. One of the main efforts in implementing OSH is the use of PPE during practical activities in workshops (Saputra et al. 2022). According to Suma'mur, PPE is a set of equipment used to protect all or part of the body from potential occupational hazards in the workplace (Suma'mur 2009). PPE functions to protect students from potential hazards such as physical injuries, exposure to hazardous substances, or work accidents that may occur during the learning process. However, field observations indicate that many students are still not disciplined in using PPE during practical activities (Setyawan and Surahmanto 2022). The use of PPE in workshop practice in vocational schools is an important part of efforts to prevent workplace accidents in educational environments. According to Lawrence Green's theory in the PRECEDE–PROCEED model, health behavior, including the use of PPE, is influenced by three main categories of factors: predisposing factors, enabling factors, and reinforcing factors (Green 1980).

There were 10 cases of occupational accidents that occurred at State Vocational High School 1, Tangerang Regency, during the past year (2024–2025). These accidents occurred during practical activities in the engineering workshops. Overall, the total number of accidents recorded across all study programs was 10 incidents. This data indicates that workplace accidents still occur in several departments with varying levels of risk. Therefore, increased supervision, adherence to occupational safety procedures, and consistent use of personal protective equipment (PPE) are required to minimize the risk of accidents in the practical learning environment.

This study addresses gaps in understanding how behavioral, enabling, and reinforcing factors interact to influence safe health practices, particularly beyond a focus on clinical outcomes. It contributes by offering an integrated framework that can improve compliance, guide interventions, and support better child (students) health outcomes.

RESEARCH METHOD

This study used a quantitative research design with a cross-sectional approach. The research was conducted in January 2026 in the engineering workshop area of Vocational High School. The study population consisted of 1,891 students, from which a sample of 205 respondents was obtained. The sampling technique used was proportionate stratified random sampling. This technique is applied when the population consists of members that are not homogeneous and are proportionally stratified (Sugiyono 2024). Stratified sampling was carried out based on the number of engineering students in each grade (Grade 10, 11, and 12). Data collection was conducted using a questionnaire with a Likert scale, and univariate, bivariate (Chi-Square), and multivariate (Logistic Regression) data analyses were performed in this study.

This study examines knowledge, attitudes, and motivation as predisposing factors because these three factors shape students' readiness and internal drive to use personal protective equipment (PPE). The availability of PPE and occupational safety training are examined as enabling factors because the behavior of using PPE can only occur when the facilities are available and students have adequate skills. Furthermore, supervision and peer influence are examined as reinforcing factors because both play a role in strengthening and maintaining PPE use behavior through control, support, and social norms within the workshop environment.

RESULTS AND DISCUSSIONS

Table 1. Univariate analysis results

Variable	Category	Total	Percentage
Behavior	Compliant	81	39.5%
	Non-compliant	124	60.5%
Knowledge	High	99	48.3%
	Low	106	51.7%
Attitude	Positive	133	64.9%
	Negative	72	35.1%
Motivation	High	125	61.0%
	Low	80	39.0%
Availability of PPE	Available	119	58.0%
	Not Available	86	42.0%
Training	Available	138	67.3%
	Not Available	67	32.7%
Supervision	Available	110	53.7%
	Not Available	95	46.3%
Peer Influence	Influential	77	37.6%
	Not Influential	128	62.4%

Based on the results of the study conducted on the relationship between knowledge, attitude, motivation, availability of personal protective equipment (PPE), training, supervision, and peer influence on PPE usage behavior, it was found that 81 respondents (39.5%) showed compliant behavior, while 124 respondents (60.5%) showed non-compliant behavior in the use of PPE. The analysis results showed that 99 respondents (48.3%) had high knowledge, while 106 respondents (51.7%) had low knowledge regarding the use of PPE. Furthermore, 133 respondents (64.9%) had a positive attitude, while 72 respondents (35.1%) had a negative attitude toward PPE usage. The analysis also indicated that 125 respondents (61.0%) had high motivation, while 80 respondents (39.0%) had low motivation regarding the use of PPE.

The analysis also showed that 119 respondents (58.0%) stated that PPE was available, while 86 respondents (42.0%) stated that PPE was not sufficiently available. A total of 138 respondents (67.3%) stated that training was available, while 67 respondents (32.7%) stated that training was not available regarding the use of PPE. In addition, 110 respondents (53.7%) stated

that supervision from teachers was available, while 95 respondents (46.3%) stated that there was no supervision from teachers regarding the use of PPE. Furthermore, 128 respondents (62.4%) stated that peers had an influence, while 77 respondents (37.6%) stated that peers did not influence the use of PPE in the vocational high school (SMK) engineering workshop.

Table 2. Results of the bivariat analysis of predisposing factors associated with PPE usage behavior

Variable	Category	PPE Use Behavior				Total		p-value	OR (95% CI)
		Compliant		Non-compliant					
		n		n	%	n	%		
Knowledge	High	37	7.4%	62	62.6%	99	100%	0.644	0.841 (0.480–1.474)
	Low	44	1.5%	62	58.5%	106	100%		
Attitude	Positive	44	3.1%	89	66.9%	133	100%	0.016	0.468 (0.260–0.841)
	Negative	37	1.4%	35	48.6%	72	100%		
Motivation	High	59	7.2%	66	52.8%	125	100%	0.008	2.357 (1.289–4.309)
	Low	22	7.5%	58	72.5%	80	100%		

This study examined knowledge, attitude, and motivation as predisposing factors because these three factors shape students' readiness and internal motivation to use personal protective equipment (PPE). Based on the results of the bivariate analysis, the p-value for the knowledge variable was 0.644 (>0.05). This indicates that there is no association between knowledge and PPE usage behavior, which is consistent with the findings of a study conducted by Rahmawati et al. (2024) the results showed that the p-value for knowledge was 0.404 (>0.05), indicating that knowledge was not associated with PPE usage behavior. This may occur because an understanding of hazards and the benefits of PPE does not necessarily lead to its implementation in practice. Another study also reported similar findings. Annisa et al. (2020) reported a p-value of 0.863 (>0.05), indicating that there was no relationship between knowledge and PPE usage behavior. However, other studies have found a relationship between knowledge and behavior toward PPE use, with a p-value of 0.000 (<0.05) reported by (Rukmana, Putri, and Novariana 2020). The absence of a significant relationship between knowledge and PPE usage behavior among students in the workshop of SMK Negeri 1 Tangerang may occur because the knowledge possessed by students has not been fully applied in daily practice. Understanding the function and benefits of PPE is not always followed by concrete actions, particularly if it is not supported by positive attitudes, strong motivation, habituation, and a practical environment that consistently enforces safety rules. As a result, although students may have adequate knowledge, this knowledge has not been sufficient to encourage the formation of compliant behavior in the use of PPE.

Other studies have also found that good knowledge about the importance of personal protective equipment (PPE) does not necessarily correspond to high compliance in its implementation across many work situations. This indicates that high knowledge alone is not sufficient to ensure proper PPE usage behavior according to safety standards, as compliance is also influenced by other factors such as workplace safety culture, PPE availability, supervision, organizational policies, as well as comfort and working conditions. Therefore, efforts to improve PPE compliance require a more comprehensive approach, not only through educational interventions to increase knowledge but also through improvements in systems, strengthening of policies, and consistent supervision to ensure that safe behavior is effectively implemented (Ningrum et al. 2026). Another study stated that a high level of knowledge regarding PPE use is not automatically followed by proper PPE usage behavior. Although most respondents understood the function and importance of PPE, non-compliance in work practices was still found. This indicates a gap between cognitive aspects and behavioral practices, where knowledge alone has not been able to encourage individuals to consistently engage in safe behavior. Therefore, this study emphasizes that improving compliance with PPE use cannot rely solely on increasing knowledge, but also requires support from other factors such as supervision, safety culture, and strict enforcement of regulations (Maylinda and Munggaran 2025). Meanwhile, a study by Safitri,

Andriyani, and Srisantyorini (2025) stated that knowledge plays an important role in shaping PPE usage behavior, as a good understanding of functions, benefits, and occupational risks becomes the basis for workers' attitudes toward occupational safety. Adequate knowledge can increase awareness of the importance of PPE as a preventive measure against workplace accidents and occupational diseases. However, the study also emphasizes that knowledge functions as a predisposing factor, meaning that its influence on PPE usage behavior does not always stand alone. Therefore, knowledge is an important initial component in encouraging PPE use, but its effectiveness largely depends on the support of other factors within the work environment.

The analysis of the relationship between attitude and motivation with PPE usage behavior showed significant associations. The chi-square test for the relationship between attitude and PPE usage behavior produced a p-value of 0.016 ($p < 0.05$), indicating a significant relationship between attitude and PPE usage behavior. Respondents with positive attitudes tended to have higher levels of compliance in PPE usage behavior, suggesting that attitude can be an important factor in encouraging compliance. Similar findings were reported by Silfiani, Rahayu, and Zaman (2025), who reported a p-value of 0.003 (<0.05), indicating a relationship between attitude and compliance with PPE usage. Attitude is related to PPE usage behavior because a positive attitude toward occupational safety encourages individuals to comply and consistently use PPE. Conversely, attitudes that do not support safety may lead to low compliance even when PPE is available. Another study also showed a relationship between attitude and PPE usage behavior with a p-value of 0.003 (<0.05) reported by (Rifai et al. 2025). However, these results are not consistent with the study by Annisa et al. (2020), which reported a p-value of 0.863, indicating no relationship between attitude and PPE compliance.

Attitude reflects an individual's readiness to act; therefore, workers with a positive attitude toward occupational safety tend to be more compliant in using PPE. Even when knowledge is already present, without a supportive attitude—such as a sense of responsibility for safety and the perception that PPE is important—PPE usage behavior may not necessarily be formed. Thus, attitude functions as a bridge between knowledge and behavior, making the development of positive attitudes toward occupational safety and health (OSH) essential for improving compliance with PPE usage (Sasmitha, Andriyani, and Srisantyorini 2025).

The analysis of the relationship between motivation and PPE usage behavior showed that the chi-square test produced a p-value of 0.008 ($p < 0.05$), indicating a significant relationship between motivation and PPE usage behavior. Motivation is associated with PPE usage behavior because it acts as an internal drive that influences students' willingness to protect themselves from occupational hazards. Individuals with high motivation tend to be more compliant in using PPE because they are aware of the importance of safety, both for their own health and for preventing accidents. Conversely, low motivation may lead to neglect of PPE usage even when knowledge and facilities are available. These findings are consistent with the study by R, Artini, and Dewi (2022), which reported a p-value of 0.002 (<0.05), indicating a relationship between motivation and compliance with PPE usage. Motivation acts as a driving force for work enthusiasm; the strength or weakness of a person's work motivation can influence the level of performance. Proper PPE usage behavior is one of the important factors in ensuring optimal work performance. However, this study is not consistent with the findings of Amini et al. (2022), which reported no relationship between work motivation and PPE usage (p-value = 1.000).

Table 3. Results of the bivariat analysis of enabling factors associated with PPE usage behavior

Variable	Category	PPE Use Behavior				Total		P value	OR (95% CI)
		Compliant		Non compliant					
		n	%	n	%	n	%		
Availability	Available	53	44.5%	66	55.5%	119	100%	0.113	1.663

Variable	Category	PPE Use Behavior				Total		P value	OR (95% CI)
		Compliant		Non compliant					
		n	%	n	%	n	%		
of PPE									(0.933–2.965)
	Less Available	28	32.6%	58	67.4%	86	100%		
Training	Available	52	37.7%	86	62.3%	138	100%	0.537	0.792 (0.438–1.434)
	Not Available	29	43.3%	38	56.7%	67	100%		

This study examined the availability of personal protective equipment (PPE) and training as enabling factors associated with PPE usage behavior among students in the workshop of SMK Negeri 1 Tangerang Regency. Based on the results of the bivariate analysis, the p-value for the PPE availability variable was 0.113 ($p > 0.05$), indicating that there was no significant relationship between PPE availability and PPE usage behavior. The availability of PPE is closely related to PPE usage behavior among students in the SMK Negeri 1 Tangerang workshop. PPE that is fully available, easily accessible, and in proper condition makes it easier for students to use PPE during practical activities, thereby encouraging compliant behavior. Conversely, limited or incomplete PPE may become a barrier for students to consistently implement PPE usage, even though they understand the importance of occupational safety. This finding is consistent with the study conducted by Silfiani et al. (2025) which reported a p-value of 0.093 (>0.05), indicating that there was no significant relationship between PPE availability and compliance with PPE usage among workers. However, this result is not consistent with another study that reported a significant relationship between PPE availability and PPE usage behavior (p-value = 0.000) by (Efendi and Srisantyorini 2023).

Based on the results of the bivariate test, the training variable showed a p-value of 0.537 ($p > 0.05$), indicating that there was no significant relationship between training and PPE usage behavior. The absence of a relationship between training and PPE usage behavior among students in the SMK Negeri 1 Tangerang workshop may be due to the fact that the training provided has not been fully implemented in daily practical activities. Training that is theoretical in nature, less continuous, or not accompanied by supervision and habituation may result in students not yet making PPE usage a habit. As a result, training that has been received does not directly influence PPE usage behavior. This finding is consistent with the study by Prasetiyo et al. (2021), which reported a p-value of 0.087 (>0.05), indicating that there was no relationship between training and PPE usage behavior because most workers had previously received education and training, yet many still neglected the use of PPE. However, other studies reported different findings, showing a significant relationship between training and PPE usage (p-value = 0.032; $p < 0.05$) as reported by (Jayati et al. 2021).

The digital world can also serve as a tool for conducting training. A study by Raharjo et al. (2025)demonstrated that safety training in the digital era can effectively increase awareness and understanding of occupational safety or activities within educational environments. Through the use of digital media, training processes can be conducted more flexibly, are easier to access, and can reach a larger number of participants. The increase in knowledge and preparedness after participating in digital training indicates that this approach is effective in supporting the implementation of safe behavior. Therefore, digital-based training has the potential to become a relevant strategy for building a stronger safety culture.

Table 4. Results of the bivariat analysis of reinforcing factors associated with PPE usage behavior

Variable	Category	PPE Use Behavior				Total		p-value	OR (95% CI)
		Compliant		Non-compliant					
		n	%	n	%	n	%		
Supervision	Available	43	39.1%	67	60.9%	110	100%	1.000	0.963 (0.549–1.688))
	Less Available	38	40.0%	57	60.0%	95	100%		
Peer Influence	Influential	28	36.4%	49	63.6%	77	100%	0.570	0.809 (0.452–1.448)
	Not Influential	53	41.4%	75	58.6%	128	100%		

This study examined supervision and peer influence as reinforcing factors associated with PPE usage behavior among students in the workshop of SMK Negeri 1 Tangerang Regency. Based on the results of the bivariate analysis, the supervision variable showed a p-value of 1.000 ($p > 0.05$), indicating that there was no significant relationship between supervision and PPE usage behavior. The absence of a significant relationship between supervision and PPE usage behavior among students in the SMK Negeri 1 Tangerang workshop may be due to supervision that has not been consistently implemented or has not been strict in enforcing safety regulations. In addition, students tend to use PPE based on personal awareness; therefore, even when supervision exists, it may not be strong enough to establish sustained compliant behavior in PPE usage.

Similar findings were reported in a study by Sutrisno et al. (2021), which reported a p-value of 0.49 (>0.05), concluding that there was no relationship between supervision and compliance with PPE usage. Supervision was considered inadequate because supervisors were not always present during working days. Supervision was conducted only briefly, yet workers continued to use PPE. Another study also reported similar results with a p-value of 1.000 (>0.05), indicating no relationship between supervision and compliance with PPE usage (Daniati and Fadilla, 2022). However, this finding is not consistent with the study by Lobis et al. (2020), which reported a significant influence of supervision on compliance with PPE usage with a significance value of 0.000 (<0.05).

Supervision is one of the key factors in improving compliance with PPE usage in the workplace. Previous studies have shown that after the implementation of routine inspections or supervision, the level of PPE usage compliance increased significantly, for example from 34% to 68% following consistent supervision. Supervision functions as a reinforcing factor that directly influences safe behavior in PPE use, helps reduce non-compliant behavior, and strengthens discipline in PPE usage through regular monitoring. In other words, supervision acts not only as a control mechanism but also as a means to encourage better safety behavior, thereby supporting the achievement of a safer working environment and reducing workplace accidents (Sasmitha, Andriyani, and Srisantyorini 2025).

Based on the results of the bivariate analysis, the peer influence variable showed a p-value of 0.570 ($p > 0.05$), indicating that there was no significant relationship between peer influence and PPE usage behavior. This may be because PPE usage behavior is more strongly driven by students' personal awareness and responsibility for their own safety. Although interaction with peers occurs during practical activities, peer influence does not always directly relate to compliance with PPE usage, especially when safety norms have not yet been strongly established within the group. In addition, students tend to follow formal rules established by the school or practical instructors rather than imitate the behavior of their peers, which may explain why peer influence does not show a meaningful relationship with PPE usage behavior.

Table 5. Results of the multivariat analysis of dominant factor associated with PPE usage behavior

Variable	B	Sig.	OR	95%CI (Lower–Upper)
Attitude	0.771	0.012	0.462	0.254–0.842
Motivation	0.867	0.006	2.381	1.289–4.397
Constant	-0.583	0.415	0.558	–

Based on the results of the multivariate analysis, the motivation variable showed a significant relationship with personal protective equipment (PPE) usage behavior, with a p-value of 0.006. The odds ratio (OR) value of 2.381 with a 95% confidence interval of 1.289–4.397 indicates that students with lower motivation have a 2.38 times greater likelihood of demonstrating non-compliant behavior compared to students who have good motivation.

From the perspective of Green's Behavioral Model, motivation is categorized as a predisposing factor that plays a role in shaping an individual's readiness and internal drive to behave. The results of this study indicate that motivation is the most dominant factor influencing PPE usage behavior. Therefore, efforts to improve compliance with PPE usage should focus on strengthening students' motivation through educational approaches, continuous guidance, and the creation of a learning environment that supports a culture of occupational safety. The findings of this study indicate that behavioral, enabling, and reinforcing factors influence adherence to good practices, which can be applied to improve the quality of children's education. By enhancing students' knowledge, attitudes, and motivation, ensuring the availability of adequate learning facilities and training, and strengthening teacher supervision and peer support, students are more likely to comply with rules and the learning process. This will create a safer and more effective learning environment, reduce the risk of errors, and ultimately improve students' learning outcomes.

CONCLUSION

Based on the results of this study on factors influencing personal protective equipment (PPE) use behavior among students in the engineering workshop of SMK Negeri 1 Tangerang Regency, most students were categorized as non-compliant in using PPE (60.5%). The analysis showed that knowledge, PPE availability, training, supervision, and peer influence were not significantly associated with PPE use behavior. In contrast, attitude and motivation were found to have significant associations with PPE use behavior. Among all variables examined, motivation emerged as the most dominant factor influencing students' compliance with PPE use. Further research should focus on vocational high school (SMK) students across different schools and technical majors to validate these findings. Longitudinal or experimental studies are needed to examine causal relationships and assess the effectiveness of interventions aimed at improving knowledge, attitudes, motivation, and PPE compliance. In addition, qualitative studies can explore students' perceptions and barriers in using PPE, while intervention-based research can test strategies such as safety training or supervision to improve safe behavior in workshop activities.

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