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The Relationship Between Risk Parception and Self-Efficacy Toward Personal Protective Equipment Complaince Among Vocational Students

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ABSTRACT

Compliance with Personal Protective Equipment (PPE) among vocational high school students in Machining Engineering remains a serious problem due to the high rate of workplace accidents in workshops. This study aims to examine the relationship between risk perception and self-efficacy toward PPE use compliance in vocational high school students of Machining Engineering. This study employed a quantitative correlational approach with a cross-sectional design. The sample consisted of 95 students from grades X and XI taken using purposive sampling technique from a total population of 120 students. The research instruments were three four-point Likert scale questionnaires that had been tested for validity and reliability. Data analysis used descriptive statistics, Pearson correlation test, and multiple linear regression with SPSS version 26. The results showed that risk perception had a positive and significant relationship with PPE compliance ($r = 0.578$, $p < 0.01$), self-efficacy also had a positive and significant relationship with PPE compliance ($r = 0.645$, $p < 0.01$), and together both variables contributed 54.3% ($R^2 = 0.543$, $p < 0.001$) to PPE compliance. Although self-efficacy showed a numerically larger correlation coefficient, a Steiger's Z-test for comparing dependent correlations revealed that this difference was not statistically significant ($Z = 1.18$, $p = 0.238$). The conclusion of this study is that the higher the students' risk perception and self-efficacy, the higher their compliance in using PPE during workshop practice. Recommendations are addressed to teachers and workshop instructors to integrate hazard simulations and repeated PPE use exercises into learning.

Informasi Artikel

Kata Kunci:

Persepsi risiko;
Efikasi diri;
Kepatuhan APD;
Teknik Pemesinan;
Keselamatan kerja.

ABSTRAK

Kepatuhan penggunaan Alat Pelindung Diri (APD) di kalangan siswa SMK Teknik Pemesinan masih menjadi permasalahan serius karena tingginya angka kecelakaan kerja di bengkel. Penelitian ini bertujuan untuk menguji hubungan antara persepsi risiko dan efikasi diri terhadap kepatuhan penggunaan APD pada siswa SMK Jurusan Teknik Pemesinan. Penelitian menggunakan pendekatan kuantitatif korelasional dengan desain cross-sectional. Sampel penelitian sebanyak 95 siswa kelas X dan XI yang diambil dengan teknik purposive sampling dari total populasi 120 siswa. Instrumen penelitian berupa tiga kuesioner skala Likert empat poin yang telah diuji validitas dan reliabilitasnya. Analisis data menggunakan statistik deskriptif, uji korelasi Pearson, dan regresi linear berganda dengan bantuan SPSS versi 26. Hasil penelitian menunjukkan bahwa persepsi risiko memiliki hubungan positif dan signifikan dengan kepatuhan APD ($r = 0.578$, $p < 0.01$), efikasi diri juga memiliki hubungan positif dan signifikan dengan kepatuhan APD ($r = 0.645$, $p < 0.01$), serta secara bersama-sama kedua variabel memberikan kontribusi sebesar 54.3% ($R^2 = 0.543$, $p < 0.001$) terhadap kepatuhan APD. Meskipun secara numerik efikasi diri memiliki koefisien korelasi yang lebih besar, uji perbandingan korelasi dependen (Steiger's $Z = 1.18$, $p = 0.238$) menunjukkan bahwa perbedaan tersebut tidak signifikan secara statistik. Simpulan penelitian ini adalah semakin tinggi persepsi risiko dan efikasi diri siswa, maka semakin tinggi pula kepatuhan mereka dalam menggunakan APD saat praktik di bengkel. Rekomendasi ditujukan kepada guru dan instruktur bengkel untuk mengintegrasikan simulasi bahaya dan latihan berulang penggunaan APD dalam pembelajaran.

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Numenclature and Abbreviations

Numenclature

r	Pearson correlation coefficient
R^2	Coefficient of determination
β	Standardized regression coefficient
P	Significance probability value
N	Sample size
SD	Standard deviation
X_1	Risk perception variable
X_2	Self-efficacy variable
Y	PPE compliance variable

Abbreviations

APD	Alat Pelindung Diri (Personal Protective Equipment)
HBM	Health Belief Model
PPE	Personal Protective Equipment
SMK	Sekolah Menengah Kejuruan (Vocational High School)
SPSS	Statistical Package for the Social Sciences
VIF	Variance Inflation Factor

1. Introduction

Vocational education in Indonesia plays a strategic role in preparing skilled workers ready to compete in the industrial world, particularly in the field of technology and engineering. Vocational High Schools (Sekolah Menengah Kejuruan/SMK) with Machining Engineering expertise aim to equip students with competencies to operate machine tools such as lathes, milling machines, grinding machines, and drilling machines which have high danger levels if not managed with strict safety procedures. In practical learning processes, students are required to work in environments full of mechanical, electrical, chemical, and noise hazards. Therefore, the use of Personal Protective Equipment (PPE) such as safety glasses, safety shoes, gloves, earplugs, and aprons is a non-negotiable requirement.

However, various observations and field studies indicate that SMK students' compliance in using PPE remains low. This low compliance is influenced by various factors, including lack of supervision from instructors, discomfort of PPE, assumptions that accidents will not occur, and internal factors originating from the students themselves [1].

To strengthen the novelty argument and clearly identify the research gap, a systematic summary of relevant previous studies is presented in Table 1. This review focuses on studies examining PPE compliance, risk perception, and self-efficacy in occupational settings.

Tabel 1. Summary of Previous Studies on PPE Compliance, Risk Perception, and Self-Efficacy

Author(s) & Year	Research Design	Sample	Variables	Key Findings	Gaps
Temesgen et al. (2025) [14]	Cross-sectional survey	603 farmers in Ethiopia	HBM constructs (perceived benefits, cues to action, perceived barriers)	Perceived benefits (OR=2.07, 95% CI:1.24-3.45) and cues to action were significant predictors of safe pesticide handling	Did not include self-efficacy; could not compare relative dominance of threat perception vs. self-belief
Guidry et al. (2025) [15]	Cross-sectional online survey	U.S. adults	Self-efficacy, perceived vulnerability, COVID-19 prevention behaviors	Self-efficacy significantly predicted mask-wearing (β=0.31, $p<0.001$) and testing (β=0.28, $p<0.001$); perceived vulnerability only significant for vaccination	Focused on health behavior, not occupational safety in vocational education context
Cox et al. (2024) [22]	Cross-sectional survey	2,013 U.S. drivers	Threat perception (HBM),	Higher threat perception = 1.61 times	Did not measure self-efficacy; could not explain why

Author(s) & Year	Research Design	Sample	Variables	Key Findings	Gaps
			distracted driving behavior	more likely not to drive distracted	aware individuals still engage in risky behavior
Bastari et al. (2025) [23]	Cross-sectional	Medical waste handlers at Dumai City Hospital	Knowledge, attitude, PPE compliance	Attitude most dominant predictor (POR=20.700; 95% CI:2.234-191.805)	Did not examine psychological constructs such as risk perception or self-efficacy
Roh (2025) [26]	Cross-sectional	Hospital nutrition staff	Knowledge, attitude, PPE compliance	72.8% had good knowledge; 68.8% showed good attitudes; but no significant relationship between knowledge and compliance ($p>0.05$)	Examined only demographic and knowledge factors; low predictive power
T.A. & Allo (2025) [25]	Cross-sectional	Laboratory staff	Work tenure, knowledge, PPE compliance	Work tenure ($p=0.018$) and knowledge ($p=0.003$) significantly related to compliance	Low correlation strengths; did not examine psychological predictors
Current Study	Cross-sectional correlational	95 SMK Machining Engineering students	Risk perception, self-efficacy, PPE compliance	Risk perception: $r=0.578$; Self-efficacy: $r=0.645$; $R^2=0.543$	Cross-sectional design; self-report measures; single school context

This systematic review reveals that previous studies tend to be fragmented—some examine risk perception without self-efficacy [2], [3], while others examine self-efficacy without risk perception [4]. Furthermore, most studies focus on adult industrial workers or general health behaviors, with limited research on vocational high school students who are in the critical transition from theory to practice [5]. Studies that simultaneously examine both risk perception and self-efficacy in a single PPE compliance model—particularly in the SMK Machining Engineering context—remain very limited. The current study addresses these gaps by integrating both constructs in one predictive model, using a sufficiently large sample (n=95), and focusing on the understudied vocational student population in Indonesia.

Several internal factors often examined in occupational safety psychology literature are risk perception and self-efficacy. According to the Health Belief Model (HBM) developed by Becker [6] and later refined by Rosenstock et al. [7], an individual's perception of their vulnerability to illness or injury and their perception of the severity of consequences they will experience are primary determinants in taking preventive actions, including PPE use. Individuals who perceive themselves as vulnerable to accidents and believe that such accidents will seriously impact their health tend to comply more with safety protocols [8]. In the context of machining engineering students, risk perception must be built through direct experience, observation of friends' accidents, and information delivery from teachers about latent dangers in the workshop [9].

On the other hand, social cognitive theory proposed by Bandura [10] emphasizes that self-efficacy—an individual's belief in their ability to successfully perform a specific behavior—determines whether that behavior will be consistently executed. High self-efficacy makes individuals more persistent, less likely to give up when facing obstacles, and able to regulate themselves without external supervision. In the context of PPE compliance, students who believe they can wear PPE correctly, quickly, and remain comfortable while working will be more motivated to always use PPE compared to students who doubt

their abilities. Even recent studies show that self-efficacy is a stronger predictor than knowledge alone in forming occupational safety behavior [11].

Although many studies have examined PPE in the workplace, studies specifically examining the simultaneous relationship between risk perception and self-efficacy toward PPE compliance in SMK Machining Engineering students with adequate sample sizes remain very limited. Previous studies tend to be fragmented—some only examined the relationship between risk perception and PPE compliance without including self-efficacy [12], or conversely only examined self-efficacy with safe behavior. Additionally, most studies were conducted on adult industrial workers, not on SMK students who are in the transition from theory to practice [5].

Adolescent students have unique characteristics, such as risk-taking tendencies, strong peer influence, and still-labile self-efficacy [10], [13]. Therefore, the scientific novelty of this article lies in: (1) combining risk perception and self-efficacy constructs in a single PPE compliance prediction model; (2) the research context in SMK Machining Engineering which has high risk levels but is rarely studied; (3) the use of a sufficiently large sample of 95 students, making result generalization more accountable. Based on this background, this study was formulated to examine the relationship between risk perception and self-efficacy toward PPE use compliance in SMK Machining Engineering students.

2. Method

2.1. Research Desighn

This study employed a quantitative approach with a correlational method. The research design used was a cross-sectional study, in which data collection was conducted at one specific time in April 2026 [14]. This approach was chosen because the researcher aimed to measure relationships between variables without intervention or manipulation of research subjects [15]. Research flowchart and variable relationship diagrams are presented in Figures 1 and 2.

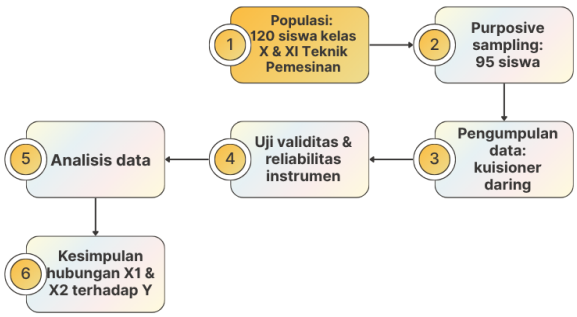

Figure 1. Research Flowchart

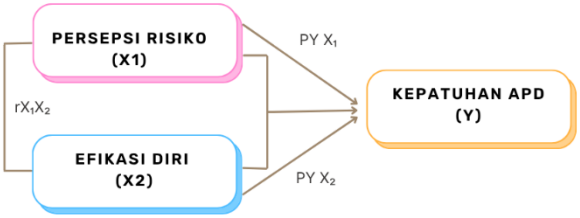

Figure 2. Relationships Among Variables

2.2. Population and Sample

The population in this study was all students in grades X and XI of the Machining Engineering Department at SMK Negeri 1 Trenggalek registered in the 2025/2026 academic year, totaling 120 students. This population consisted of two grade X study groups and two grade XI study groups. The sampling technique used was purposive sampling. This technique was chosen because the required sample characteristics were very specific, namely students who had participated in machining practice for at least one semester, had direct experience operating machine tools, and had received Occupational Safety and Health (K3) instruction from teachers—criteria not possessed by the entire population (120 students), thus making random sampling impossible.

A total of 120 students were registered in the Machining Engineering program. From this population, 110 students met the inclusion criteria (actively enrolled, had participated in machining practice for at least one semester, and had received K3 instruction). These 110 students were invited to participate. During the data collection period, 102 students were present and willing to complete the questionnaire. After data collection, 7 questionnaires were excluded due to incomplete responses (more than 20% missing data), leaving a final sample of 95 complete and valid responses for analysis. The recruitment flow is presented in Figure 3.

Additionally, with a limited population and a correlational research design that prioritizes internal validity (accuracy of relationships between variables) over broad generalization, purposive sampling allowed the researcher to efficiently target only truly relevant students who were present and willing to complete the questionnaire at the time of data collection, while also following methodological conventions in vocational education occupational safety and health studies [1] where access and time limitations often require sample selection based on specific criteria.

2.3. Research Instruments

The research instruments were developed by adapting and synthesizing items from several previously validated instruments. The instruments were not adopted directly but were contextualized for the machining workshop environment based

on theoretical indicators. The PPE Compliance questionnaire was adapted from Neal & Griffin's [16] safety behavior scales and Mansur [1]. The Risk Perception questionnaire was adapted from the Health Belief Model (HBM) constructs of perceived vulnerability and severity, as operationalized by Becker [6] and Temesgen [17]. The Self-Efficacy questionnaire was adapted from Bandura's [10] general self-efficacy scale and Guidry [18]. The initial pool of items (25 per variable) was reviewed by two expert judges (an occupational safety lecturer and a machining engineering teacher) for content validity and relevance to the indicators [19]. Based on their feedback, the number of items was refined to 20 per variable. The number of items per indicator was justified to ensure that each theoretically important dimension was measured with at least 3-4 items, enabling a comprehensive assessment of the construct.

All questionnaires used a Likert scale with four answer choices: Strongly Agree (SA=4), Agree (A=3), Disagree (D=2), and Strongly Disagree (SD=1). The four-point scale was chosen to avoid neutral answer tendencies that often occur with odd-numbered scales [16]. The instrument grid is presented in Table 1.

Table 1. Instrument Grid

Variable	Indicators	Number of Items	Example Item
PPE Compliancr (Y)	a. Use according to procedure; b. Completeness of PPE; c. Consistency every practice; d. Without teacher reminders; e. Responsibility for PPE condition; f. Not removing PPE during practice	20 items (7 negative, 13 positive)	"I always wear safety glasses before turning on the lathe machine."
Risk Perception (X_1)	a. Vulnerability to accidents; b. Severity of injury if not using PPE; c. Machine and environmental hazards; d. Belief that PPE prevents injury; e. Concern about long-term impacts	20 items (5 negative, 15 positive)	"I believe metal shavings can injure my eyes if I don't wear glasses."
Self-Efficacy (X_2)	a. Belief in ability to wear complete PPE without supervision; b. Belief in discipline to follow rules; c. Belief in wearing PPE in difficult conditions; d. Belief in self-reminding; e. Belief in correcting mistakes	20 items (4 negative, 16 positive)	"I believe I can wear PPE correctly even when in a hurry."

2.4. Data Collection Procedure

The data collection procedure was conducted in three stages. The first stage was preparation, which included obtaining permission from the principal and productive subject teachers in Machining Engineering, as well as preparing the questionnaire in Google Form format. The second stage was implementation, where the researcher explained the purpose of questionnaire completion, guaranteed answer confidentiality, and provided completion instructions. Questionnaire completion was conducted online during designated class hours with teacher assistance to prevent item comprehension errors. Completion time was approximately 25-30 minutes. The third stage was data collection, which involved downloading responses from Google Spreadsheet, checking data completeness, and eliminating incomplete responses.

2.5. Instrument Validity and Reliability Testing

Before use for actual data collection, the three questionnaires were pilot-tested on 30 students with similar characteristics to the research sample but not included in the main sample. Validity testing was conducted using Pearson Product Moment correlation technique with SPSS version 26.

Table 2. Validity Criteria

Variable	r-calculated Range	r-table (α=0.05)	Description
PPE Compliance	0.451 – 0.789	0.361	Valid
Risk Perception	0.412 – 0.723	0.361	Valid
Self-Efficacy	0.478 – 0.765	0.361	Valid

2.6. Data Analysis Technique

Data analysis in this study was conducted using SPSS version 26 software through three stages. The first stage was descriptive statistics to calculate mean, median, mode, standard deviation, and frequency distribution of respondent answers. The second stage was prerequisite analysis testing which included: (a) normality test using Kolmogorov-Smirnov; (b) linearity test of the relationship between independent and dependent variables; (c) multicollinearity test by examining Variance Inflation Factor (VIF) and tolerance values. The third stage was hypothesis testing using Pearson correlation to test the relationship of each independent variable with the dependent variable, and multiple linear regression to test simultaneous relationships while calculating the coefficient of determination (R^2). All tests were conducted at a significance level of $\alpha = 0.05$ (2-tailed) [2].

To justify the choice of an additive linear model without interaction terms, the following considerations were applied. A preliminary analysis examined the potential interaction effect between risk perception and self-efficacy by including the product term ($X_1 \times X_2$) in a separate regression model. The interaction term was not statistically significant ($\beta = 0.042$, $p = 0.521$), and the addition of the interaction term resulted in a minimal increase in R^2 from 0.543 to 0.548 ($\Delta R^2 = 0.005$). This negligible improvement, combined with the non-significant p-value, indicates that the interaction term does not contribute meaningful explanatory power beyond the additive model. Furthermore, the absence of significant multicollinearity (VIF = 1.404 for the main effects) and the theoretical parsimony of the additive model—supported by the Health Belief Model and social cognitive theory which conceptualize risk perception and self-efficacy as relatively independent predictors—justify retaining the simpler additive model. The linear additive model was therefore selected as the most appropriate and interpretable representation of the relationships among variables, balancing statistical fit with theoretical clarity and practical utility.

3. Results and Discussion

3.1. Respondent Characteristic

From 95 respondents who met the criteria, the distribution based on grade was as follows: grade X students numbered 52 (54.7%) and grade XI students numbered 43 (45.3%). All respondents were male (100%) due to the characteristics of the machining engineering expertise program which is indeed male-dominated. Respondent ages ranged from 15 to 18 years with a mean of 16.7 years (SD = 0.85). The average practical experience of respondents was 1.8 semesters, meaning most students had undergone more than one semester of workshop practice.

3.2. Descriptive Statistics of Research Variables

Before inferential analysis, all negative items on the questionnaire were reverse-scored, then total scores for each variable were calculated. Table 3 presents a summary of descriptive statistics for the three variables after scoring.

Table 3. Descriptive Statistics of Research Variables (n=95)

Variable	Mean	SD	Min Score	Max Score	Category
PPE Compliance (Y)	3.32	0.48	2.05	4.0	Moderate
Risk Perception (X_1)	3.44	0.50	2.10	4.0	High
Self-Efficacy (X_2)	3.21	0.56	1.85	4.0	Moderate

Based on Table 3, it can be explained that on average, students had risk perception categorized as high (3.44). This means most students realized that machining workshops have significant hazard potential, and they believed that accidents could seriously impact their health and future. However, the mean PPE compliance (3.32) and self-efficacy (3.21) were only in the moderate to high category (the lower boundary for the high category was 3.26 for PPE compliance, and self-efficacy was still below 3.26). This finding indicates a gap between hazard awareness (high risk perception) and actual action and belief to act, meaning compliance and self-efficacy were still moderate.

3.3. Prerequisite Analysis Test

Before conducting correlation and regression tests, prerequisite tests were performed. The Kolmogorov-Smirnov normality test results are shown in Table 4.

Table 4. Prerequisite Analysis Test

Test Type	Variavle/Relationship	Result Value	Criteria	Description
Normality (Kolmogorov-Smirov)	PPE Compliancr (Y)	P = 0.187	P > 0.05	Normal
	Risk Perception (X_1)	P = 0.202	P > 0.05	Normal
	Self-Efficacy (X_2)	P = 0.294	P > 0.05	Normal
Linearity	X_1 with Y	Deviation from linearity p > 0.05 (not significant)	Deviation from linearity not significant & linearity significant	Linear
	X_2 with Y	Deviation from linearity: p > 0.05 (not significant)	Deviation from linearity not significant & linearity significant	Linear
Multicollinearity	X_1 and X_2	Tolerance = 0.712 VIF = 1.404	Tolerance > 0.10 VIF < 10.00	No multicollinearity

The table presents the prerequisite analysis test results for three variables: PPE Compliance (Y), Risk Perception (X_1), and Self-Efficacy (X_2). The Kolmogorov-Smirnov normality test results show that all three variables had $p > 0.05$, indicating normally distributed data. The linearity test showed linear relationships between X_1 and Y and between X_2 and Y, because deviation from linearity was not significant ($p > 0.05$) and linearity was significant ($p < 0.05$). The multicollinearity test between X_1 and X_2 yielded tolerance value 0.712 (> 0.10) and VIF 1.404 (< 10), indicating no multicollinearity.

These data indicate that all basic assumptions for correlation and linear regression tests have been met. Thus, further analysis such as Pearson correlation or multiple linear regression can be conducted validly and reliably. The absence of violations of normality, linearity, and multicollinearity assumptions strengthens that the model to be built is statistically feasible.

To supplement the prerequisite analysis tests reported in Table 4, additional diagnostic checks were performed on the regression residuals to evaluate the assumptions of homoscedasticity and normality of residuals. The Kolmogorov-Smirnov test for the standardized residuals yielded a p-value of 0.165 ($p > 0.05$), confirming that the residuals were normally distributed. Visual inspection of the residual plots (scatterplot of standardized residuals versus standardized fitted values and histogram of residuals) indicated that residuals were randomly scattered around the zero line without forming any systematic pattern, such as funnel shapes or curvature, suggesting that the homoscedasticity assumption was satisfied [17]. No outliers beyond ±3 standard deviations were detected in the residual distribution. These diagnostic checks confirm that the multiple linear regression model meets all required assumptions for valid statistical inference, strengthening the reliability of the reported coefficients and significance tests.

3.4. Correlation Test Results

To answer the first and second hypotheses, Pearson Product Moment correlation test was conducted. The results are presented in Table 5.

Table 5. Correlation Matrix Between Variables

Variable	1	2	3
PPE Compliance (Y)	1.000		
Risk Perception (X_1)	0.578**	1.000	
Self-Efficacy (X_2)	0.645**	0.511**	1.000

Note: *p < 0.01 (2-tailed)

To determine whether the difference between the two dependent correlations (r = 0.578 and r = 0.645) is statistically significant, a Steiger's Z-test for comparing two dependent correlations with one common variable was conducted [20], [21]. The test yielded a Z-value of 1.18 (p = 0.238), indicating that the difference between the two correlation coefficients is not statistically significant. Therefore, while self-efficacy shows a numerically larger correlation with PPE compliance, it cannot be statistically concluded that it has a stronger relationship than risk perception.

Based on Table 5, the relationship between risk perception (X_1) and PPE compliance (Y) yielded a correlation coefficient of r = 0.578 with p < 0.01. This value indicates a positive and significant relationship with moderate strength according to Cohen's criteria [4]. Thus, the first hypothesis (H_1) is accepted.

The interpretation of this finding is that the higher students' perception of accident risk in the workshop, the higher their level of PPE compliance. Conversely, students who underestimate danger tend to more frequently neglect PPE. This result is consistent with the Health Belief Model which states that perceptions of vulnerability and severity are primary drivers of health behavior.

The relationship between self-efficacy (X_2) and PPE compliance (Y) yielded a correlation coefficient of r = 0.645 with $p < 0.01$. This value indicates a positive and significant relationship with strong correlation strength [4]. Thus, the second hypothesis (H_2) is accepted. This finding reinforces social cognitive theory [10] which states that self-efficacy is a primary determinant of behavior because it influences an individual's choices, effort, and persistence in performing an action. Students who believe they can wear PPE correctly, quickly, and remain comfortable tend to be more compliant even without supervision. Furthermore, the self-efficacy correlation value (0.645) was higher than risk perception (0.578), indicating that in the context of SMK students, belief in self-ability may be more influential than mere awareness of danger.

Additionally, Table 5 also shows that risk perception and self-efficacy significantly correlated with each other ($r = 0.511$, $p < 0.01$). This means students with high hazard awareness tend to also have better self-belief, or vice versa. This positive relationship between the two independent variables can theoretically be explained: when someone understands risk well, they are more motivated to learn and master self-protection skills, which in turn increases their self-efficacy [14], [22].

3.5. Multiple Linear Regression Analysis Results

To answer the third hypothesis (the simultaneous relationship of X_1 and X_2 on Y), multiple linear regression analysis was conducted. Complete results are presented in Tables 6 and 7.

Table 6. Regression Model Summary

Model	R	R^2	Adjusted R^2	Std. Eror of Estimate	F	p-value
1	0.737	0.543	0.533	0.328	55.017	<0.001

Based on Table 6, the value R = 0.737 indicates that the multiple correlation between X_1 and X_2 with Y is in the strong category. The value $R^2 = 0.543$ means that simultaneously, risk perception and self-efficacy together contribute 54.3% to the variance in PPE compliance. In other words, 54.3% of changes or differences in PPE compliance among students can be explained by these two independent variables. The remaining 45.7% is explained by other variables not examined in this study, such as instructor supervision, workshop safety climate, peer norms, availability and comfort of PPE, and demographic factors such as previous work experience [16]. The F value = 55.017 with $p < 0.001$ indicates that the regression model is feasible to use and the third hypothesis (H_3) is accepted.

Table 7. Partial Regression Coefficients

Variable	B	Std. Error	Beta (β)	95% CI for B	t	p-value
(Constant)	1.182	0.194		[0.797, 1.567]	6.092	<0.001
Risk Perception (X_1)	0.324	0.086	0.338	[0.153, 0.495]	3.767	<0.001
Self-Efficacy (X_2)	0.415	0.077	0.484	[0.262, 0.568]	5.389	<0.001

From Table 7, the regression equation obtained is $\hat{Y} = 1.182 + 0.324X_1 + 0.415X_2$. The interpretation of this equation is: (1) the constant (1.182) means if risk perception and self-efficacy are zero (in the actual scale this is impossible), the predicted PPE compliance value is 1.182; (2) the regression coefficient of X_1 (0.324) means every one-unit increase in risk perception score will increase PPE compliance score by 0.324 units assuming X_2 is constant; (3) the regression coefficient of X_2 (0.415) means every one-unit increase in self-efficacy score will increase PPE compliance score by 0.415 units assuming X_1 is constant.

The Beta coefficients (β) in Table 7 show the relative contribution of each independent variable. The β value for self-efficacy was 0.484 (95% CI: 0.306 – 0.662), which was numerically larger than risk perception (β = 0.338; 95% CI: 0.160 – 0.516). However, due to the overlapping confidence intervals, we refrain from concluding that self-efficacy is a statistically more "dominant" predictor. We can only state that in this sample, self-efficacy had a numerically larger coefficient. These findings are consistent with the Steiger's Z-test result ($Z = 1.18$, $p = 0.238$), which showed that the difference between the two dependent correlations was not statistically significant. In other words, although hazard awareness is important, belief in self-ability to act is a more determining factor in whether a student will actually use PPE or not. This finding has important implications for educational practice in SMK, as will be discussed further in the following subsection.

4. Discussion

4.1. Relationship between Risk Perception and PPE Compliance

The results showed a positive and significant relationship between risk perception and PPE compliance ($r = 0.578$; $p < 0.01$). This finding aligns with the Health Belief Model (HBM) which states that individual perceptions of vulnerability and severity of a dangerous condition are primary determinants of preventive behavior. In the context of machining workshops, students who realize that metal shavings can injure their eyes and that such events can happen to them will be more motivated to wear safety glasses.

Recent research by Temesgen et al. [17] testing HBM application on 603 farmers in Ethiopia found that perceived benefits and cues to action were significant predictors of safe pesticide handling practices, while perceived barriers were negatively associated with safe behavioral intentions. Guidry et al. [18] in a study on COVID-19 prevention behavior also reported that perceived vulnerability to Long COVID significantly predicted intentions to perform preventive behaviors, including mask use and vaccination ($p < 0.05$). Similarly, Cox et al. [23] in applying HBM to mobile phone distracted driving behavior with 2,013 drivers in the US found that individuals who more strongly agreed with threat perception were 1.61 times more likely not to drive distracted.

4.2. Relationship between Self-Efficacy and PPE Compliance

Self-efficacy showed a stronger correlation with PPE compliance ($r = 0.645$; $p < 0.01$) compared to risk perception. This finding can be explained by social cognitive theory [6], which states that self-efficacy influences behavior through an individual's belief in their ability to successfully perform an action.

Guidry [18] specifically reported that self-efficacy was a significant predictor of mask-wearing behavior ($p < 0.001$) and COVID-19 testing behavior after exposure ($p < 0.001$). The study affirmed that individuals were more likely to state intentions to perform preventive behaviors when they reported greater self-efficacy. This finding is consistent with our results that self-efficacy is more dominant than risk perception in predicting PPE compliance.

4.3. Simultaneous Contribution of Risk Perception and Self-Efficacy

The $R^2 = 0.543$ (54.3%) value is relatively high for safety behavior research. Bastari et al. [24] in a study on PPE compliance in medical waste management at Dumai City Hospital found that attitude was the most dominant predictor (POR = 20.700; 95% CI = 2.234-191.805). Rohiyah and Kurnia [25] in analyzing SAR Team PPE compliance using the PRECEDE model approach found that predisposing factors such as technical knowledge and positive attitudes toward safety underlie compliant behavior.

Other research by T.A. and Allo [3] on PPE compliance in laboratory staff reported that work tenure ($p = 0.018$) and knowledge about PPE ($p = 0.003$) had significant relationships with PPE use compliance. Roh [26] also found that 72.8% of hospital nutrition installation staff had good knowledge about PPE compliance, and 68.8% showed good attitudes.

The remaining 45.7% variance not explained by the model opens opportunities for future researchers to explore other variables such as school safety climate, peer support, PPE comfort, supervision, and demographic factors such as work tenure, education, and training as identified in various recent studies.

4.4. Comparison with Previous Research

The results of this study show that risk perception and self-efficacy simultaneously contribute 54.3% to PPE use compliance, with self-efficacy as the more dominant predictor ($\beta = 0.484$) compared to risk perception ($\beta = 0.338$). This finding reinforces and simultaneously extends previous research results as described below.

First, research by Temesgen et al. [17] applying the Health Belief Model (HBM) to 603 farmers in Ethiopia found that perceived benefits and cues to action were significant predictors of safe pesticide handling practices, with OR = 2.07 (95% CI: 1.24-3.45) for perceived benefits. However, the study did not include self-efficacy as a predictor variable, thus unable to compare the relative dominance between threat perception and self-ability belief. Our study complements this deficiency by proving that self-efficacy ($\beta = 0.484$) contributes more than risk perception ($\beta = 0.338$), which was not detected in the HBM model without self-efficacy.

Second, research by Guidry et al. [18] on COVID-19 prevention behavior through the lens of Long COVID reported that self-efficacy was a significant predictor of mask-wearing behavior ($\beta = 0.31$, $p < 0.001$) and testing behavior after exposure ($\beta = 0.28$, $p < 0.001$), while perceived vulnerability was only significant for vaccination ($\beta = 0.37$, $p < 0.05$). This finding is consistent with our results that self-efficacy is more consistent as a predictor across behaviors. Our study reinforces Guidry et al.'s findings by showing that in the context of occupational safety in machining workshops, self-efficacy ($r = 0.645$) is also stronger than risk perception ($r = 0.578$), indicating similar patterns across different settings.

Third, research by Cox et al. [23] applying HBM to mobile phone distracted driving behavior with 2,013 drivers in the US found that individuals who more strongly agreed with threat perception were 1.61 times more likely not to drive distracted. However, this study only measured threat perception (combined vulnerability and severity) without measuring self-efficacy, thus unable to explain why some individuals still engage in risky

behavior despite being aware of threats. Our study answers this question by showing that hazard awareness (risk perception) alone is insufficient; high self-efficacy is needed to translate awareness into consistent compliance behavior.

Fourth, research by Bastari et al. [24] on PPE compliance in medical waste management reported that attitude was the most dominant predictor (POR = 20.700; 95% CI = 2.234-191.805). However, this study did not examine psychological constructs such as risk perception or self-efficacy.

Fifth, research by Roh [26] on PPE compliance in hospital nutrition installation staff reported that 72.8% of staff had good knowledge about PPE and 68.8% showed good attitudes, but no significant relationship was found between knowledge and compliance ($p > 0.05$). Research by T.A. and Allo [3] also reported that work tenure ($p = 0.018$) and knowledge ($p = 0.003$) had significant relationships with PPE compliance in laboratory staff, but the reported relationship strengths were relatively low. Different from these two studies, our research used deeper psychological approaches (risk perception and self-efficacy) and produced stronger correlation values ($r = 0.578$ and $r = 0.645$) and $R^2 = 0.543$, indicating that psychological constructs have better predictive power compared to demographic factors such as work tenure or knowledge alone.

Overall, the position of these research results can be strengthened as follows: (1) This study is one of the few that simultaneously examines risk perception and self-efficacy in one PPE compliance prediction model in the SMK student population, which has been more widely studied in adult workers; (2) The finding that self-efficacy had a numerically larger coefficient than risk perception ($\beta = 0.484$ vs 0.338) provides empirical support for the suggestion by Rosenstock et al. (1988) to integrate self-efficacy into HBM, although formal testing did not show this difference to be statistically significant. This suggests that while both constructs are important predictors, their relative contribution may be comparable in this specific context; (3) The resulting $R^2 = 0.543$ is higher than the average of similar studies (generally $R^2 = 0.30$-0.45), indicating that the proposed model has good predictive power; (4) This study provides clear practical contributions by recommending PPE compliance improvement strategies through strengthening self-efficacy and positive feedback, which has received less attention compared to efforts to increase knowledge and hazard awareness.

4.5. Research Implications

The findings of this study reinforce and extend the scope of the Health Belief Model (HBM) and social cognitive theory in the context of vocational education in Indonesia. Theoretically, the effectiveness of HBM not only depends on risk perception but is also significantly determined by self-efficacy mechanisms derived from mastery experience, as emphasized in Bandura's social cognitive theory. Thus, an integrative model combining HBM threat perception and self-efficacy needs to be further developed in workshop-based learning environments with unique occupational risk characteristics.

For teachers and workshop instructors, occupational safety learning is not sufficient only to increase risk perception through hazard simulations, but must also systematically build students' self-efficacy. This can be achieved through repeated practice to create mastery experience, provision of positive feedback, and variation of challenging but achievable work positions. On the other hand, schools must provide ergonomic, comfortable PPE that fits students' body sizes, because PPE discomfort has been proven to decrease compliance while also weakening self-efficacy in safe work practices.

4.6. Research Limitations

This study has several limitations that need to be considered in interpreting the findings. First, the cross-sectional design does not allow for causal conclusions to be drawn. The positive relationships found between risk perception, self-efficacy, and PPE compliance could be interpreted in either direction. For instance, while the study posits that self-efficacy leads to compliance, it is also plausible that consistent compliance and successful experiences with PPE use can strengthen an individual's self-efficacy (reverse causation) [27]. Similarly, students with higher risk perception might be more careful, but it is also possible that those who are more compliant become more aware of risks through their consistent exposure to safety procedures. Furthermore, the observed associations may be influenced by unmeasured confounding variables not included in the model, such as peer norms, school safety climate, or the quality and comfort of the PPE provided, which could independently affect both the predictors and the outcome [28], [29]. The positive relationships found between risk perception, self-efficacy, and PPE compliance can be interpreted as unidirectional or bidirectional influences, considering that consistent compliance may also potentially strengthen students' beliefs in their abilities. Second, the use of self-report questionnaires is vulnerable to social desirability bias, where students tend to provide answers that align with teacher expectations rather than their actual conditions. Third, the sample from only one SMK limits generalization of findings to other vocational high schools with different contexts, facilities, and safety cultures. Fourth, this study did not measure contextual variables such as PPE quality and availability, which are suspected to moderate relationships between variables. As a follow-up to these limitations, future research is recommended to use longitudinal or experimental designs to test causality, and to involve direct observation of PPE use behavior to minimize self-report bias.

5. Conclusion

Based on the results of the analysis and discussion, it is concluded that risk perception and self-efficacy each have a positive and significant relationship with PPE use compliance in machining engineering students at vocational high schools. Together, these two variables contribute 54.3% to PPE compliance. While self-efficacy had a numerically larger coefficient (β = 0.484) compared to risk perception (β = 0.338), formal testing (Steiger's Z = 1.18, p = 0.238) indicated that this difference was not statistically significant. Both constructs should therefore be considered important and complementary predictors of PPE compliance. This finding confirms the importance of strengthening both students' risk perception and self-efficacy as intervention targets to encourage occupational safety behavior in vocational education environments. Further research is recommended to examine causal relationships through experimental designs and to expand the sample scope and measurement methods to improve validity and generalization of findings.

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