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Relationship between the completeness of occupational safety facilities and the rate of workplace accidents

Akbar Hanafi*, Mulianti, Irzal and Junil Adri

Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Padang, **INDONESIA**

*Corresponding Author:
akbarhanafi51@gmail.com

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Abstract

Workplace safety and health are crucial aspects that must be implemented in industries and workshops. This aims to ensure that the tasks performed in workshops adhere to established standards and prevent workplace accidents. This research aims to determine whether there is a correlation between the completeness of safety facilities and the rate of workplace accidents and to measure the strength of this correlation. The subjects of this study are 12th-grade students in the Mechanical Engineering Department at SMK Negeri 5 Padang. We employed a cluster random sampling technique to select our sample. Data was collected through observations to assess the completeness of safety facilities, where qualitative data was converted into quantitative data. Additionally, students filled out questionnaires to measure the rate of workplace accidents. The results of the hypothesis testing indicate that the significance value (sig) is 0.00, which is lower than the significance level (sig) of 0.05. Therefore, it can be concluded that there is a significant correlation between the completeness of safety facilities and the rate of workplace accidents. The coefficient test results show that the relationship between the two variables has a strength of 76.4%.

Keywords.: Completeness, Safety Facilities, Work Accidents, Workshop, Mechanical Engineering

Introduction

Occupational health and safety is one form of effort to create a safe, healthy workplace to protect and free from work accidents and increase work efficiency and productivity (Ismara et al., 2023; Shafi et al., 2020). Work accidents cause casualties and material losses for workers, can disrupt the production process as a whole, damage the work environment and impact the surrounding community. Therefore, to prevent work accidents in a workshop or industrial, a company must implement and tighten occupational safety and health factors (Acheampong & Kemp, 2022). Occupational safety can also be interpreted as an effort or activity to create a safe working environment and prevent any accidents. Occupational safety applies in all workplaces, whether on land, at sea, on the surface, in the water or in the air (Carbone et al., 2020). Work safety is defined as thoughts and efforts to ensure the perfection of labour both physically and spiritually. From a scientific point of view, work safety is defined as knowledge and implementation to prevent the possibility of accidents and accidents and occupational diseases (Chatigny, 2022; Shan, 2022).

According to (Mansyur et al., 2022), The Law on Health states that companies are specifically obliged to examine the health, mental and physical condition of new workers and those who will be transferred to new workplaces, following the nature of the work given to workers, as well as periodic medical examinations. According to (Chatigny, 2022), Occupational Safety has been regulated in the obligation for

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every workplace to implement an occupational safety and health management system, including regulations regarding implementing personal protective equipment (PPE). Related to the implementation of personal protective equipment, many aspects are influential, including human factors, conditions or specifications of PPE, and the convenience of using the correct PPE can significantly reduce the rate of accidents. This can be achieved if PPE is used and designed based on studies of ergonomic occupational safety and health (K3). According to (Oah et al., 2018), Many factors influence the occurrence of work accidents, some of which are human factors, safety and health support equipment and the Occupational Safety and Health Management System (SMK3) that exists in the organisation.

Based on the observations of researchers who carry out educational field practice at SMK Negeri 5 Padang, occupational safety and health equipment is inadequate, making students pay less attention to occupational safety and health during practice and lack of teacher supervision, with adequate occupational health and safety equipment so that it can ensure the health and safety of students during practice. In addition, work accidents also often occur, such as sore eyes after welding because they do not use safety facilities and several other minor work accidents are considered trivial (Polak-Sopinska et al., 2019). Factors that make the lack of attention to student safety are incomplete and inappropriate occupational safety and health equipment because it has been too long, such as welding helmets whose glass protects students' eyes when welding is damaged. There are no gloves to protect hands from sparks during practice. The student must wear adequate occupational safety and health equipment, such as welding helmets, gloves, safety shoes, practical clothes, and protective headgear (Ismara et al., 2021; Khairat et al., 2022; Rauh et al., 2021). Attitudes and actions for safety and health to prevent work accidents that affect the health of students and harm the school is an obligation that must be considered (Acheampong & Kemp, 2022). No one wants a work accident, and it would be nice if the school prepared adequate occupational safety and health equipment so that students can avoid work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang. Therefore, the role of the teacher is also significant to provide an understanding of occupational safety and health to students by giving examples of the use of occupational safety and health equipment when students practice in the workshop; students who are practising using welding machines or lathes must wear work clothes, glasses, gloves, and safety shoes. Initial observations made by researchers obtained some data such as safety glass available in the mechanical engineering workshop of SMK Negeri 5 Padang as many as 25 (twenty-five) pieces and only 18 (eighteen) are suitable for use, only 5 (five) safety helmets are available, and ear protection devices are not available.

In addition, the completeness of work safety facilities is considered in order to ensure occupational safety and health during practice and the realisation of the objectives of SMK, which creates a reliable workforce and has the ability in its field to be ready to enter the world of work (O'Toole & Calvard, 2020). Based on the background of the problems described, this study aims to determine the relationship between the completeness of occupational safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang.

Methods

Type of Research

This research belongs to the type of correlational research, which intends to detect the extent to which variations in a factor are related to variations in other factors based on the correlation coefficient (Hidayat et al., 2021). This study aims to determine whether there is a relationship between variables in the study.

Sample

The sampling technique in this study used random sampling (Bhardwaj, 2019); the sample is part of the number of characteristics the population possesses. Samples are part of the population, so sampling must use specific methods based on existing considerations. There are several types of variables, including discrete and continuous variables, independent and dependent variables, nominal, ordinal, interval, and ratio variables, as well as quantitative and qualitative variables (Nassaji, 2020).

Data collection techniques

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Data collection techniques are an essential part of the research design because if the title of the scientific work of the research design has been approved to be researched (Richardo et al., 2023), Then the researcher can start collecting data. The first step to be taken in collecting data is to seek information from the literature on matters relevant to the title of the paper. Relevant information is extracted and recorded on information cards. In addition to searching for information from the literature, researchers can start going to the field. The information recorded on information cards or going directly to the field is one of the so-called data collection techniques (Meilani & Aiman, 2021; Richardo et al., 2023).

The data collection tools used are questionnaires and observations; assessment questionnaires are data collection techniques that are carried out by giving respondents a set of written questions to answer (Syahril et al., 2021). This observation is carried out by observing what is being researched, the results of which can describe the field in the form of attitudes, actions, conversations, and interpersonal interactions (Larson et al., 2019).

Data analysis

The data analysis techniques used were requirement tests (normality and linearity), descriptive data analysis and research hypothesis testing (correlation and coefficient tests). Data analysis was carried out using SPPS 26 software.

Results and discussion

Research Results

This research was conducted at SMK Negeri 5 Padang, which is located at Jalan Beringin Raya No. 4, Lolong Belanti, North Padang Sub-district, Padang City, West Sumatra in the odd semester (August-December) of the 2022/2023 school year. The type of research used is correlational research. This research is used to determine whether or not there is a relationship between the completeness of work safety facilities and the risk of work accidents in the Mechanical Engineering Workshop of SMK Negeri 5 Padang. The research sample will be taken from the population of students in class XII TPM 1 and XII TPM 2 SMK Negeri 5 Padang. The sample in this study was 58 students who practised in the SMK Negeri 5 Padang mechanical engineering workshop.

Descriptive Analysis

Descriptive analysis aims to describe the data of each variable presented in the form of frequency distribution (Goh & Ong, 2023).

Completeness of Safety Facilities

Data on the completeness of work safety facilities variables were obtained from observations of the mechanical engineering workshop of SMK Negeri 5 Padang. Based on the results of the calculation of descriptive analysis of the completeness of work safety facilities variables obtained as presented in the following table:

Table 1. Descriptive Analysis of Completeness of Work Safety Facilities

Statistics		
Completeness of Work Safety Facilities		
N	Valid	10
	Missing	19
Mean		41.40
Median		40.50
Mode		35
Std. Deviation		7.933
Minimum		32
Maksimum		55
Sum		414

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The results of the descriptive analysis calculation of the completeness of the work safety facilities variable above are known: the average value is 41.40; the median value is 40.50; the mode value is 35; the maximum value is 55 in, and the minimum value is 32. After the descriptive analysis is carried out, the frequency data analysis of the completeness of work safety facilities variable is carried out, as shown in the table below:

Table 2. Frequency of Work Safety Facility Completeness Variables

Class Interval	Class Interval
32-39	32-39
40-47	40-47
48-55	48-55

The frequency table for the completeness of work safety facilities shows that data with a value range of 32-39 are five items, 40-47 are three items, and 48-55 are two items.

Workplace Accident Rate

Data on work accident rate variables were obtained from a questionnaire given to class XII TPM 2 SMK Negeri 5 Padang students. Based on the results of the calculation of descriptive analysis of work accident rate variables obtained from class XII TPM 2 students of SMK Negeri 5 Padang, as presented in the following table:

Table 3. Descriptive Analysis of Work Accident Rate

Statistics		
Workplace Accident Rate		
N	Valid	29
	Missing	0
Mean		75.86
Median		76.00
Mode		76
Std. Deviation		2.838
Minimum		71
Maksimum		82
Sum		2200

The results of the descriptive analysis calculation of the work accident rate variable above are known: the average value is 75.86; the median value is 76; the mode value is 76, the maximum value is 82, and the minimum value is 71. After the descriptive analysis is carried out, the frequency data analysis of the work accident rate variable is carried out, as shown in the table below:

Table 4. Frequency of Occupational Accident Rate

Class Interval	Frequency
71-74	8
75-78	16
79-82	5

The frequency table of work accident rates above shows that data with a value range of 71-74 are eight people, a value range of 75-78 are 16 people, and a value of 79-82 is five people.

Analysis Prerequisite Test

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The analysis requirement test aims to test whether the collected data meets the requirements for analysis (Bommert et al., 2020). In this study, the normality and linearity tests were applied as prerequisite tests of analysis, following the results of the prerequisite tests of analysis.

Normality Test

The normality test is carried out to determine whether the data distribution is normally distributed (Putra Tampi et al., 2022). The test was conducted using the Kolmogorof-Smirnov test with Alpha (0.05). The normality test uses the help of the SPSS Version 26.0 programme. The criteria for normally distributed data are as follows: if the significance value ≥ 0.05, then the data is normally distributed; if the significance value ≤ 0.05, then the data is not normally distributed. The following are the normality test results on the tool variable's completeness.

Table 5. Normality Test of Work Accident Rate

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig
Workplace Accident Rate	.136	29	.183

The data above shows that the sig value in the Kolmogorof-Smirnov test is 0.183; this shows that the sig value> 0.005, meaning that the work accident rate variable data is normally distributed. Because the data is normally distributed, the linearity test can be carried out.

Linearity Test

The linearity test intends to determine whether two variables have a linear relationship or not (Hidayat et al., 2021). The linearity test was carried out in this study with the SPSS Version 26.0 programme. The decision-making criteria are if the significance ≥, then the X and Y variables are declared linear, and if the significance ≤, the X and Y variables are declared non-linear. The following are the results of the linearity analysis of the two variables.

Table 6. Linearity Test

ANOVA Table						
		Sum of Squares	df	Mean Square	F	Sig.
Workplace Accident Rate Completeness of Work Safety Facilities	Combined	461.233	5	92.247	3.509	.124
	Linearity	422.440	1	422.440	16.067	.016
	Deviation Linearity	38.793	4	9.698	.369	.821
	Within Groups	105.167	4			
	Total	566.400	9			

The data above shows that the sig value in Deviation from Linearity is 0.821; this shows that the sig value> 0.05, which means that there is a linear relationship between the completeness of work safety facilities and the level of work accidents. Because the data of both variables are linear, the prerequisite test for analysis has been fulfilled, and the subsequent analysis can be carried out.

Hypothesis Test

The correlation test was used to determine the magnitude of the influence of the completeness of work safety facilities on the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang. The following are the results of the correlation test.

Correlation Test

This research measured the relationship between the completeness of work safety facilities and the level of work accidents in the SMK Negeri 5 Padang mechanical engineering workshop. After obtaining the results of the comparison of the Person Correlation (RXY) value with the r

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table, it can be seen whether the relationship is a significant relationship with the level α = 0.05 or 5%, with the following criteria if the sig value (2-tailed) ≤ α value (0.05), then there is a significant relationship and if the sig value (2-tailed) ≥ α value (0.05), then there is an insignificant relationship.

Table 7. Correlation Test

Correlations			
		Completeness of Work Safety Facilities	Workplace Accident Rate
Completeness of Work Safety Facilities	Pearson Correlation	1	.864**
	Sig. (2-tailed)		.001
	N	29	10
Workplace Accident Rate	Pearson Correlation	864**	1
	Sig. (2-tailed)	.001	
	N	10	10

The table above shows that between the completeness of safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang, there is a correlation coefficient (r) of 0.864 with a significance of 0.001. This means that there is a positive correlation between the completeness of safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang with a low level of relationship, and the correlation is significant because p < 0.05 (0.000 < 0.05).

Coefficient Test

The calculation of the coefficient of determination is carried out to determine the magnitude of the influence of the variable relationship between the completeness of work safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang. The formula used is as follows:

KD = (r2) x 100%
KD = (0,864)2 x 100%
KD = 0,746 x 100% = 74,6%

From the results of the coefficient of determination using the formula above, it is known that the amount of the coefficient of determination is 74.6%. This means that the independent variables' ability to explain the dependent variable's variance is 74.6%. This means there is a 25.4% variance in the dependent variable, which is explained by other factors.

Discussion

The results of descriptive analysis calculations known from the results of observations made into quantitative data with the help of SPSS Software version 26.0, the completeness of work safety facilities is known, the average completeness of work safety facilities is 41.40, the median value of completeness of work safety facilities is 40.50; the mode value of completeness of work safety facilities is 35, the maximum value of completeness of work safety facilities is 55 and the minimum value of completeness of work safety facilities is 32. Based on the results of the frequency of completeness of work safety facilities above, data with a value range of 32-39 are five items, a value range of 40-47 are three items, and a value range of 48-55 are two items. From this data, it can be concluded that the average completeness of safety facilities is less complete because it does not reach an average of 100.

The results of descriptive analysis calculations known from the distribution of questionnaires on the level of work accidents are known: the average level of work accidents is 75.86; the median value of the level of work accidents is 76; the mode value of the level of work accidents is 76, the maximum value of the level of work accidents is 82 in, and the minimum value is 71. Based on the results of the frequency of the level of work accidents above, the data with a range of 71-74 are eight students, the range of values 75-78 is 16 people, and the range of values 79-82 is

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five students. The results show that the level of work accidents in the SMK Negeri 5 Padang mechanical engineering workshop is still in the high category.

The results of the prerequisite test analysis consisting of normality and linearity analysis show that the data from the completeness of work safety facilities and the level of work accidents are normal and linear. This is evidenced by the sig value in the Kolmogorov-Smirnov test of 0.183, which shows that the sig value is> 0.005 and on linearity, the known sig value on Deviation from Linearity of 0.821 shows that the sig value> 0.05.

The results of hypothesis testing in the study by applying the correlation test show that between the completeness of work safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang, there is a correlation coefficient (r) of 0.864 with a significant 0.001. This means that there is a positive correlation between the completeness of safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang with a low level of relationship, and the correlation is significant because $p < 0.05$ ($0.000 < 0.05$).

The results of the coefficient of determination using the formula above show that the coefficient of determination is 76.4%, meaning that the ability of the independent variables to explain the variance of the dependent variable is 76.4%, and there is 25.4% variance in the dependent variable which is explained by other factors.

Conclusion

Based on the research data and the results of the analysis, it can be concluded that between the completeness of safety facilities and the level of work accidents in the mechanical engineering workshop of SMK Negeri 5 Padang, there is a correlation coefficient (r) of 0.864 with a significance of 0.001. This means there is a positive relationship between the completeness of work safety facilities and the level of work accidents with a low level of relationship, and the correlation is significant because $p < 0.05$ ($0.000 < 0.05$). Moreover, the results of the coefficient of determination using the formula above show that the amount of the coefficient of determination is 76.4%, meaning that the ability of the independent variable to explain the variance of the dependent variable is 76.4%, and there is 25.4% variance in the dependent variable explained by other factors. The benefits of complete safety facilities can provide students with smooth practice in the workshop and prevent students from becoming victims of work accidents. In the sense that the level of work accidents can be minimised if supported by complete safety facilities.

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Declaration

Author contribution

Akbar Hanafi as a researcher and data collector for the facility relationship. Dr. Ir. Mulianti, M.T. is a provider of direction and methods in research; Drs. Irzal, M. Kes. evaluating research methods and data analysis, Dr. Junil adri, S.Pd., M.Pd.T. evaluating Background of the Problem.

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Conflict interest

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