Path Analysis in the Application of Occupational Health and Safety in the Ship Machinery Laboratory

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Abstract: This study aims to analyze the influence of learning attitudes, learning knowledge and learning motivation on the Application of Occupational Health and Safety using path analysis. The method used in this study is the quantitative method with a correlational research type. The population in this study is cadets of the Ship Machinery Study Program, at Yogyakarta Maritime High School. Sample The selection of research samples is carried out using the saturated sampling method or census method, which is all members of the sample population. The data analysis method uses path analysis with the Smartpls3 SEM model. Based on the results of the study, there was a significant positive direct influence of learning attitudes on the learning motivation of cadets. Learning attitudes have a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. Furthermore, there is a significant positive direct influence of learning knowledge on the learning motivation of cadets. Learning knowledge has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. Learning motivation has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory.

Keywords: Attitudes; Knowledge; Motivation; Occupational Health and Safety; Path Analysis

Introduction

The implementation of Occupational Health and Safety in the workplace aims to ensure that workers and others in the workplace are always safe and healthy and ensure that all production sources can be used safely and efficiently (Adamopoulos & Syrou, 2022). Potential sources of hazards and risks of work accidents that can occur in the workplace include exposure to chemical radiation, infection, electric shock and falling or bumping. Other potential sources of hazards include all situations and conditions caused by errors and omissions due to human factors or human error and factors outside humans, such as materials, equipment, and the environment to Occupational Health and Safety. The results showed that 85% of work accidents were sourced from human factors (Stranks, 2007).

The application of Occupational Health and Safety must be trained in the educational process to run effectively to be able to obtain knowledge (Weinstock & Slatin, 2012). Knowledge is everything that is seen, known, or understood towards a certain object that is captured through the five senses, namely, the senses have a basis for learning knowledge (Zagzebski, 2017; Simanullang et al., 2023). Knowledge is obtained through cognitive processes, where a person must understand or first recognize science to know the knowledge (Blooma et al., 2013). Increased knowledge and understanding in mastering the material is the result of the learning process (Astriawati, 2020). In addition to increasing knowledge, the learning process will also make a person’s thinking power even better (Wibowo & Astriawati, 2020; Putri et al., 2023). So that the person can think critically about a problem especially related to the...
Application of Occupational Health and Safety (Cameron & Hare, 2008).

According to Astriawati et al., (2020) the Ship Machinery Study Program, at Yogyakarta Maritime College as one of the study programs that prepares workers in the shipping sector, is required to be able to produce graduates expected by the world of work and industry, namely having technical abilities and good work attitudes, including in implementing Occupational Health and Safety. To be able to form a good work attitude, it is necessary to have a strategy to improve the quality of the application of Occupational Health and Safety through the learning process of Occupational Health and Safety in the school environment, especially when practising in the ship machinery laboratory (Ahad et al., 2021). Work attitude management was first planted from the learning attitude of a cadet, especially in the maritime field (Hartanto et al., 2023).

According to Wahyuddin et al., (2022) and Fetiana et al., (2022), attitude is a tendency to approach or avoid, positive or negative towards various social circumstances, whether it is institutions, individuals, situations, ideas, concepts and so on. Psychologists have defined attitudes with many variations (Wilson et al., 2000). But basically, these opinions complement each other. According to Larashati & Khasanah, (2022) says that attitude is an internal state that influences individual action choices towards objects, individuals, and events. Meanwhile, according to Osborne et al., (2003), that attitude is a general evaluation made by humans towards themselves, others, objects or issues. The tendency to react or one's attitude towards something, a person or thing can be classified into accepting (liking), rejecting (disliking), and indifferent (not caring) attitudes. Batra & Ray (1986) classify the form of learning attitudes into several classifications, including the following: feelings of pleasure or displeasure, feelings of agreement or disapproval, and feelings of like or dislike. According to Fatimah et al., (2023), attitudes consist of various levels, namely: receiving, responding, valuing, and responsible.

In a good learning process, there needs to be motivation so that the results are maximized (Akbariah et al., 2023). Motivation is the drive and strength in a person to achieve certain goals that he wants to achieve (Astriawati & Wibowo, 2019; Rizki et al., 2023). The intended goal is something that is outside of humans so that human activities are more directed because someone will try to be more enthusiastic and active in doing something (Susilawati et al., 2023). The function of motivation in learning includes motivation as encouraging the emergence of an action/activity, directing someone to do, and motivation will help someone achieve their goals (Pertiwi et al., 2021). In the process of learning-teaching interaction, motivation is needed to encourage students to learn diligently (Rizaldi et al., 2022). This research is important because in general later graduates of the Ship Machinery Study Program (Level III technical experts) will work as executors or supervisors of beginner forces, where the work is directly related to equipment, tools, machinery, materials that contain elements of danger. The purpose of this study is aims to analyze the influence of learning attitudes, learning knowledge and learning motivation on the Application of Occupational Safety and Health using pathway analysis.

Method

The method used in this study is a quantitative method with a correlational research type. Correlation research is a study that involves data collection actions to determine whether there is a relationship and the level of relationship between two or more variables (Fraenkel et al., 2012). The population in this study is cadets who used the ship machinery laboratory in 2023 in the ship machinery study program at Yogyakarta Maritime College with a total of 30 people. Sample The selection of research samples is carried out using the saturated sampling method or census method, which is all members of the sample population (Martinez-Mesa et al., 2016). Data Analysis Techniques in PLS with Smart PLS software version 4.0 with the following stages (Wong, 2013): Outer Model testing, Measurement of the Inner Model; and Hypothesis Test Results.

Outer Model testing specifies the relationship between latent variables and indicator indicators, or it can be said that the outer model defines how each indicator relates to its latent variables. The tests carried out on the outer model, are as follows: Convergent Validity, Discriminant Validity, Average Variance Extracted (AVE); and Composite Reliability (Niehaves & Ortbach, 2016). The convergent validity value is the value of the loading factor on the latent variable with its indicator indicator. The expected value is > 0.7. The value of discriminant validity is a cross-loading factor value that is useful for determining whether the construct has adequate discrimination, namely by comparing the loading value on the intended construct must be greater than the loading value with other constructs. The expected AVE value is > 0.5. Data that has a composite reliability of > 0.7 has high reliability. Cronbach Alpha. Reliability test reinforced with Cronbach Alpha. The expected value is > 0.7 for all constructs.

Measurement of the Inner Model consists of the Inner Model and t values. Testing of the structural model (Inner Model) is carried out by looking at the R-Square value which is a goodness-fit test of the model. The
second test is to look at significance by looking at the value of parameter coefficients and statistical significance t values in the Algorithm Bootstraping report - Path Coefficients. The t-statistic value is greater than the t-table and significance (t-table significance 5% = 1.96) (Pering, 2020). While Hypothesis Test Results consist of data in .csv format (comma, separated, value); design of the model and input data; analysis with PLS algorithm and results. The framework of empirical causal relationships between paths can be created through path diagrams as follows in Figure 1.

![Figure 1. Research Path](image)

**Description:**
- $X_1$ : learning attitudes
- $X_2$ : learning knowledge
- $X_3$ : learning motivation
- Y : Application of Occupational Health and Safety (OHS)

- $\rho X_1 X_3$ : $X_1$ (learning attitudes) $\rightarrow$ $X_3$ (learning motivation)
- $\rho YX_1$ : $X_1$ (learning attitudes) $\rightarrow$ Y (Application of OHS)
- $\rho X_2 X_3$ : $X_2$ (learning knowledge) $\rightarrow$ $X_3$ (learning motivation)
- $\rho YX_2$ : $X_2$ (learning knowledge) $\rightarrow$ Y (Application of OHS)
- $\rho YX_3$ : $X_3$ (learning motivation) $\rightarrow$ Y (Application of OHS)

### Result and Discussion

The results of the model design and input data as well as the results of the PLS Algorithm in Figure 2 of the model on Figure 2. Based on Figure 2, validity testing uses convergent validity and discriminant validity. Based on the rule of thumb, to assess convergent validity seen from the value of loading factor greater than 0.7. Figure 2 shows that all indicators of each variable have a loading factor value greater than 0.7, hence the indicators in the model are declared valid. In addition to the loading factor value, the AVE value in each construct must also be considered to meet the convergent validity requirements. Figure 2 shows that the AVE value of each variable has a value greater than 0.5, learning attitude gets a score of 0.80, learning knowledge gets a score of 0.79, learning motivation gets a score of 0.75 and application of OHS gets a score of 0.72 and then the convergent validity requirement has been met.

![Figure 2. Model design and input data and PLS Algorithm results](image)

#### Table 1. Correlation Value Between Constructs

<table>
<thead>
<tr>
<th>Variable</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>0.897</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>0.845</td>
<td>0.892</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>0.878</td>
<td>0.860</td>
<td>0.870</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.887</td>
<td>0.742</td>
<td>0.860</td>
<td>0.851</td>
</tr>
</tbody>
</table>

Discriminant validity testing is carried out by comparing the square root of each construct in the model with correlations between other constructs. Table 1 shows that the AVE square root value of a construct is greater than the correlation between constructs, so the former larcker criterion discriminant validity test has been satisfied. In Table 1 the discriminant value of validity, is seen from the AVE (averaged variance extracted) value and AVE root value >0.5. The AVE root value of each variable is greater than the AVE root, and its correlation with other variables so that the validity discriminant is met. The Model Collinearity Test is used in evaluating by looking at the Variance Inflation Factor (VIF) value. If the VIF value > 5 there is a collinearity problem but if the VIF value is < 5 there is no collinearity problem. In Table 2 the following is a test of model collinearity.

From Table 2 it can be seen that the VIF values of all variable indicators <5, so there is no collinearity of each variable indicator measured. Reliability tests can be seen from the value of Cronbach's alpha>0.7, composite reliability (rho-a) >0.7 and composite reliability (rho-c) >0.6. Table 3 shows the test results of the following reliability tests.
Table 2. Model Collinearity Test

<table>
<thead>
<tr>
<th>Correlation</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 -&gt; X3</td>
<td>3.506</td>
</tr>
<tr>
<td>X1 -&gt; Y</td>
<td>3.736</td>
</tr>
<tr>
<td>X2 -&gt; X3</td>
<td>3.506</td>
</tr>
<tr>
<td>X2 -&gt; Y</td>
<td>3.836</td>
</tr>
<tr>
<td>X3 -&gt; Y</td>
<td>3.636</td>
</tr>
</tbody>
</table>

Table 3. Reliability test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s alpha</th>
<th>Composite reliability (rho_a)</th>
<th>Composite reliability (rho_c)</th>
<th>The average variance extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>0.878</td>
<td>0.88</td>
<td>0.93</td>
<td>0.80</td>
</tr>
<tr>
<td>X2</td>
<td>0.87</td>
<td>0.90</td>
<td>0.92</td>
<td>0.79</td>
</tr>
<tr>
<td>X3</td>
<td>0.84</td>
<td>0.85</td>
<td>0.90</td>
<td>0.75</td>
</tr>
<tr>
<td>Y</td>
<td>0.90</td>
<td>0.91</td>
<td>0.93</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Table 3 shows each variable value of Cronbach’s alpha>0.7, composite reliability (rho-a) >0.7 and composite reliability (rho-c) >0.6 so that it can be concluded that the reliability requirements have been met by all variables. R-Square is the root proportion of variation in the value of an affected variable (endogenous) that can be explained by the variable that directs it (exogenous). The criterion is if the value of R²=0.75 has a substantial influence (large) or if the value of R²=0.50 has a moderate influence (moderate) and if the value of R²=0.25 then the influence is weak (small). SmartPLS indicates the R-Square of the colour of the graph if green indicates a good effect, or red indicates a bad effect, as seen in Figure 3.

From Table 4, the results of the influence of X1 (learning attitudes) to X3 (learning motivation) obtained 5.50 are classified as large, X1 (learning attitudes) to Y (Application of OHS) obtained 0.149 classified as medium, X2 (learning knowledge) to X3 (learning motivation) of 0.09 is classified as medium while X2 (learning knowledge) to Y (Application of OHS) of 0.002 is relatively small and X3 (learning motivation) -> Y (Application of OHS) is classified as small. The path coefficient value indicates the direction of influence of the exogenous variable on its endogenous variable. The significance level used is 5% with a T-table value of 2.042. A T-statistic value of > 2.042 indicates an accepted hypothesis, whereas a T-statistic value < 2.042 indicates the hypothesis is rejected, as seen in the following Table 5.

Table 4. F² value

<table>
<thead>
<tr>
<th>Correlation</th>
<th>f-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 -&gt; X3</td>
<td>5.50</td>
</tr>
<tr>
<td>X1 -&gt; Y</td>
<td>0.15</td>
</tr>
<tr>
<td>X2 -&gt; X3</td>
<td>0.09</td>
</tr>
<tr>
<td>X2 -&gt; Y</td>
<td>0.002</td>
</tr>
<tr>
<td>X3 -&gt; Y</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 5. Bootstrapping Value

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Path Coefficient</th>
<th>T-Statistics</th>
<th>Probability Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 -&gt; X3</td>
<td>0.88</td>
<td>12.81</td>
<td>0.000</td>
</tr>
<tr>
<td>X1 -&gt; Y</td>
<td>0.84</td>
<td>2.69</td>
<td>0.001</td>
</tr>
<tr>
<td>X2 -&gt; X3</td>
<td>0.12</td>
<td>2.43</td>
<td>0.000</td>
</tr>
<tr>
<td>X2 -&gt; Y</td>
<td>0.03</td>
<td>2.23</td>
<td>0.000</td>
</tr>
<tr>
<td>X3 -&gt; Y</td>
<td>0.07</td>
<td>3.15</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Based on Table 5, the results of the study show that X1 (learning attitudes) has a positive influence with a
Path Coefficient value of 0.88 and significant with a T-statistic value of 12.81 against X3 (learning motivation). X1 (learning attitudes) has a positive influence with a Path Coefficient value of 0.84 and is significant with a T-statistic value of 2.69 against Y (Application of OHS). X2 (learning knowledge) has a positive influence with a Path Coefficient value of 0.12 and is significant with a T-statistic value of 2.4 against X3 (learning motivation). X2 (learning knowledge) has a positive influence with a Path Coefficient value of 0.03 and significant with a T-statistic value of 2.23 against Y (Application of OHS). X3 (learning motivation) has a positive influence with a Path Coefficient value of 0.07 and is significant with a T-statistic value of 3.15 against X3 Y (Application of OHS).

Based on the results of the study, there was a significant positive direct influence of learning attitudes on the learning motivation of cadets of the Ship Machinery Study Program, at Yogyakarta Maritime College. Learning attitudes have a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory, meaning that if there is a change in learning attitudes it will have a direct effect on changes in the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. In other words, if Learning attitudes increase, it increases the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory and statistically has a significant effect.

Furthermore, there is a significant positive direct influence of learning knowledge on the learning motivation of cadets of the Ship Machinery Study Program, at Yogyakarta Maritime College. Learning knowledge has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory, meaning that if there is a change in learning knowledge it will have a direct effect on changes in the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. In other words, if learning knowledge increases, it increases the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory and statistically has a significant effect.

Learning motivation has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory, meaning that changes in learning motivation have a unidirectional influence on changes in the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. If learning motivation increases, there will be an increase in the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory and statistically have a significant effect. According to Ndoa & Jumadi (2022) and Dini et al., (2023) that Learning motivation is one of the essential aspects that are must-have by cadets to achieve optimal competence. These competencies as standards for creating individuals who are capable of competing in the workplace (Bahtiar et al., 2023).

Conclusion

Based on the results of the study, there was a significant positive direct influence of learning attitudes on the learning motivation of cadets of the Ship Machinery Study Program, at Yogyakarta Maritime College. Learning attitudes have a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. Furthermore, there is a significant positive direct influence of learning knowledge on the learning motivation of cadets of the Ship Machinery Study Program, at Yogyakarta Maritime College. Learning knowledge has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory. Learning motivation has a positive and significant effect on the Application of Occupational Health and Safety (OHS) in the Ship Machinery Laboratory.

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Author Contributions

Conceptualization: Ningrum Astriawati, data curation: Waris Wibowo, funding acquisition: Prasetya Sigit Santosa, Yudhi Setiyantara, methodology: Ningrum Astriawati, Benny Hartanto; visualization: Ningrum Astriawati, writing—original draft: Benny Hartanto, writing—review & editing: Waris Wibowo, Yudhi Setiyantara

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Conflicts of Interest

No Conflicts of interest.

References


