The effect of interpretation of technical drawings and workshop facilities on machining practice competencies

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Abstract. The purpose of this study was to determine the effect of students' ability to interpretation of technical drawing and workshop facilities on machining practice competencies in vocational high school (VHS) of Muhammadiyah Prambanan. This research is an ex post facto research with the subject being 11th-grade students of Mechanical Engineering consisting of 4 classes with a total sample of 96 respondents. The data collection technique uses a questionnaire (Likert scale four answers), observation, and documentation where the data are analyzed using descriptive analysis techniques and multiple linear regression. The results of this study indicate that there is a significant effect between interpretation of technical drawings and workshop facilities on machining practice competencies in vocational high school.

1. Introduction

Future development is marked by the rapid pace of development of science and technology. The progress of science and technology also has an impact on the political, economic, social, and cultural fields so that the challenges of Indonesia's development in the future will be even more significant and faced with more complex problems. This causes the acceleration of the process of change that involves all aspects of life. The change process provides a new perspective on development, meaning that future development orientation must be prioritized on improving the quality of Indonesia's human resources. Improving the quality of education is one way to improve the quality of human resources where education is a central role in the development of human resources. The function and purpose of national education are expected that students become independent and responsible individuals [1]. Quality education is education that can produce graduates who have competencies, both academic and vocational competencies, which are based on personal and social competencies, as well as noble moral values, which are overall life skills [2]. The uncertainty in which a person is required to be able to construct and adapt knowledge, attitudes, and skills by the experience they have and the context they face is very vital [3].

Vocational high school (VHS) is one of the formal education that prepares graduates to be ready to work and is certainly able to compete professionally. VHS of Muhammadiyah Prambanan is one of the vocational schools with a private status accredited A. VHS has objectives, including (1) preparing
students to be able to realise the goals Muhammadiyah education; (2) preparing students to become productive people, able to work independently, fill job openings in DU/DI as middle-level workers by the competency in the chosen expertise program; (3) preparing students to have a professional attitude and have an entrepreneurial spirit; (4) preparing students to be able to choose a career, be tenacious and be persistent in competing; (5) preparing students with science, technology and art to be able to develop themselves in the future both independently and through higher education levels; (6) equipping students with competencies that are following the chosen expertise program. The VHS curriculum should be designed in such a way as to follow the development of industry demands. The learning model at the vocational school course is also developed in order to produce independent and professional graduates. Work-based learning (WBL) becomes one of the alternative learning models that can be applied in schools in the context of developing students' attitudes, knowledge, and skills. This model can be applied in combination to get real experience from two places, namely at school and at work/industry [4]. Rahdiyanta, Nurhadiyanto, Munadi (2019) research results show that the learning process using WBL is more suitable and dominant about the readiness of student work at the time of machining practice [5].

Mechanical Engineering is one of the expertise programs in VHS of Muhammadiyah Prambanan. Some teachers think that there are still students who are not proficient in interpretation of technical drawing when implementing practice take learning activities. Some of the conditions are that most students are not yet proficient in reading pictures so that the results of their work do not meet the standards, this is based on the results of the questionnaire given to students. The results of observations from 4 classes found approximately 40% of students who were not proficient in reading drawings, thus experiencing inaccurate sizes, misreading the correct sequence of working drawings during machining practice. Based on these data, it can be concluded that there are still students of Mechanical Engineering who lack understanding about pictures, even up to the measuring instrument. As a result, students who will practice must wait for friends who have finished their jobs or ask the teacher who teaches so that the learning conditions become not optimal in the learning. Besides that, when some students were waiting in line to do machining practices, not many of them chose to go to the canteen, so that in this condition it also triggered other students to go to the canteen to eat or drink outside of recess.

Based on the background of the problems outlined above, it is necessary to investigate the effect of interpretation of technical drawings and workshop facilities on machining practice competencies in vocational high school.

2. Method
This research is an ex-post-facto study carried out at VHS of Muhammadiyah Prambanan with a research sample many 96 students. Data collection techniques used are questionnaires, observation, and documentation. A questionnaire is used to determine the implementation of learning and the obstacles experienced by students. Observation is used to determine the conditions of learning in VHS of Muhammadiyah Prambanan. The documentation was used to find out the background of teachers and students in the Department of Machining Engineering at VHS of Muhammadiyah Prambanan. Data were then analysed using descriptive techniques and multiple linear regression.

3. Results and Discussion
Variability test were investigated in this study. The value of r count for all items in question is more excellent than r table 0.188 so it can be concluded that all items are declared valid. Reliability test is a test which has a consistent result in the measure to be measured [6]. The technique used to measure internal consistency in this study uses Alpha Cronbach’s technique. Questionnaire as a measure declared reliable if the value of Alpha Cronbach’s more excellent than 0.6. If the Alpha Cronbach’s value is less than 0.6, then the questionnaire as a measuring device is declared unreliable. The reliability test results are shown in table 1.
Table 1. Reliability test results

| Variable                  | Alpha Cronbach’s | Critical value | Information |
|---------------------------|------------------|----------------|-------------|
| Interpretation of technical drawing | 0.806            | 0.6            | Reliable    |
| Workshop facilities       | 0.817            | 0.6            | Reliable    |

Table 1 shows that interpretation of technical drawing variable value of Alpha Cronbach’s is greater than 0.6 (0.806 > 0.6) so it is said reliable. Workshop facilities variable value of Alpha Cronbach’s greater than 0.6 (0.817 > 0.6) so that it is stated as reliable. It can be concluded that the questionnaire was declared reliable. Data related to the effect of reading ability on practice competencies can be seen in Table 2. Table 2 can be explained into a pie chart, shown in figure 1.

Table 2. Variable of interpretation of technical drawing

| Category   | Freq. | Percentage |
|------------|-------|------------|
| High       | 56    | 51.4%      |
| Medium     | 52    | 47.7%      |
| Low        | 1     | 0.9%       |
| Total      | 109   | 100%       |

Figure 1. Diagram of interpretation of technical drawing

The diagram in figure 1 shows that out of 109 respondents there were 56 respondents in the high category (51.4%), 52 respondents in the moderate category (47.7%), and there was 1 respondent in the low category (0.9%). Based on these results, it can be concluded that the respondents’ assessment of the variable interpretation of technical drawing is high. As for the variable of workshop facilities can be seen in Table 3. Table 3 can be explained in a pie chart, shown in figure 2.

Table 3. Variable of workshop facilities

| Category   | Frequency | Percentage |
|------------|-----------|------------|
| High       | 33        | 30.3%      |
| Medium     | 72        | 66.1%      |
| Low        | 4         | 3.7%       |
| Total      | 109       | 100%       |
The diagram in Figure 2 shows that of the 109 respondents there were 33 respondents in the high category (30.3%), 72 respondents in the moderate category (66.1%), and there were four respondents who were in the low category (3.7%). Based on these results, it can be concluded that the respondents’ assessment of the workshop facilities variable is moderate.

Normality test is done to find out whether the data is normally distributed or not, in this study using Kolmogorov Smirnov. The results of the normality test are shown in Table 4. Table 4 shows that the variable of interpretation of technical drawing the sig value is higher than the limit (0.111 > 0.05). It can be concluded that the data are normally distributed. Variable of workshop facilities the sig value is greater than the limit (0.055 > 0.05). It can be concluded that the data are normally distributed. The variable of machining practice competencies sig value is greater than the limit (0.0148 > 0.05); it can be concluded that the data are normally distributed.

| Variable                              | Sig value | Limit | Information |
|---------------------------------------|-----------|-------|-------------|
| Interpretation of technical drawing   | 0.111     | 0.05  | Normal      |
| Workshop facilities                   | 0.055     | 0.05  | Normal      |
| Machining practice competencies       | 0.148     | 0.05  | Normal      |

Linearity test is used to determine whether the data tested is linear or not. The details are shown in Table 5. Table 5 shows that the variable of interpretation of technical drawing the sig value is higher than the limit (0.800 > 0.05). It can be concluded that the research data is linear. Variable workshop facilities sig value is higher than the limit (0.099 > 0.05); it can be concluded that the research data is linear.

| Variable                              | Sig.  | Limit | Information |
|---------------------------------------|-------|-------|-------------|
| Interpretation of technical drawing * Machining practice competencies | 0.800 | 0.05  | Linear      |
| Workshop Facilities * Machining practice competencies            | 0.099 | 0.05  | Linear      |

Multicollinearity test is used to determine whether the data are interconnected or not between the variable of interpretation of technical drawing with workshop facilities. The details are shown in Table 6. Table 6 shows that the variable of interpretation of technical drawing the VIF value is less than 10 (1.021 < 10). It can be concluded that there is no multicollinearity. The variable of workshop facilities VIF value is smaller than 10 (1.021 < 10). It can be concluded that there is no multicollinearity.
Table 6. Multicollinearity test

| Variable                     | Tolerance | VIF  | Information                     |
|------------------------------|-----------|------|----------------------------------|
| Interpretation of technical  | 0.980     | 1.021| There is no multicollinearity    |
| workshop facilities         | 0.980     | 1.021| There is no multicollinearity    |

Heteroscedasticity test is used to find out whether there is interference or not between the data interpretation of technical drawing with the workshop facilities. Details are shown in Table 7. Table 7 indicates that the variable of interpretation of technical drawing sig value is higher than the limit (0.142 > 0.05). It can be concluded that there is no heteroscedasticity. The variable of workshop facilities sig value is greater than the limit (0.198 > 0.05). It can be concluded that there is no heteroscedasticity.

Table 7. Heteroscedasticity test

| Variable                     | Sig.      | Limit | Information                          |
|------------------------------|-----------|-------|--------------------------------------|
| Interpretation of technical  | 0.142     | 0.05  | There is no heteroscedasticity       |
| workshop facilities         | 0.198     | 0.05  | There is no heteroscedasticity       |

Hypothesis testing is done to prove the effect of interpretation of technical drawing and workshop facilities on the results of machining practice competencies using multiple linear regression analysis. The summary of the results of the regression analysis is shown in Table 8.

Table 8. Multiple linear regression test

| Variable                     | B         | Beta | t count | Sig t | Sig. |
|------------------------------|-----------|------|---------|-------|------|
| (Constant)                   | 57.557    |      |         |       |      |
| Interpretation of technical  | .277      | 0.335| 4.584   | 0.000 | Sig. |
| workshop facilities         | 0.260     | 0.532| 7.291   | 0.000 | Sig. |
| F count                      | 42.726    |      |         |       |      |
| Sig F                        | 0.000     |      |         |       |      |
| R square                     | .446      |      |         |       |      |
| Dependent Variable           |          |      |         |       | : Machining practice competencies |

Table 8 shows that there is a positive effect of interpretation of technical drawing on the machining practice competencies of students of VHS Muhammadiyah Prambanan, this is evidenced from t value of 4.584 with 0.000 significance value less than 0.05 (0.000 < 0.05) and the regression coefficients have a positive value of 0.277. There is a positive effect of workshop facilities on the machining practice competencies of VHS Muhammadiyah Prambanan students. This is evidenced by the t value of 7.291 with a significance value of 0.000 less than 0.05 (0.000 < 0.05) with regression coefficient having a positive value of 0.260. The results of multiple linear regression analysis tests indicate that there is a significant value of 0.000 (0.000 < 0.05). This value can prove that the hypothesis is accepted, which means that there is an effect of interpretation of technical drawings and workshop facilities on machining practice competencies in vocational high school.

4. Conclusion
There is the effect of interpretation of technical drawings and workshop facilities on machining practice competencies in vocational high school.
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