STUDENTS’ COMPETENCES IN PRACTICUMS OF VARIOUS COMPETENCIES IN MACHINING ENGINEERING

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Abstract. This study aimed at investigating productive practicums of various competencies and the competences of Machining Engineering department students of Muhammadiyah Bantul Vocational High School. It is a descriptive study which employed both quantitative and qualitative research designs. The practicums of various competencies consisted of seven stages led by two teachers. Those stages are opening, presenting the introductory theory, demonstrating, conducting productive practicums of various competencies, evaluating, giving feedback, and closing. Based on the data analysis, the percentage of students’ response is 70%, and it is categorized as good. The average score of the students’ competences is 81.67, and it is also categorized as good. Finally, the percentage of students’ activity aspect is 90%, and it is also categorized as very good.

1. Introduction
Vocational education has a very important role in supporting the industrial advancement in Indonesia by generating human resources who have competences in specific fields. According to the law No 20/2003 on the national education standards, vocational education is an institution where students learn to work in certain fields and to be ready to continue their further study. Education does not only function as a labor generator, but it is supposed to generate labors who are in accordance with the society and the workforce demands (ArifMarwanto: 2008).

Many people argue that Vocational High School is one of the types of Education which aims to create competent and ready human resources who are ready to compete in the industrial world and who have the abilities to create their own jobs. Vocational High Schools (VHS) are required to provide students with soft skill and hard skill. In addition, they are responsible for improving the quality of learning especially learning in practicum classes. It is expected that students’ competences acquired during theory classes can be used in the workshop courses.

However, Vocational High Schools have not optimally conducted the ideal education yet. There is often some discrepancy between the acquired theories and the practice, and even the theory and practice learnt at schools are different from the real conditions of workforce (Directorate of PSMKs 2017: 2).
Efforts to develop students’ competences should be done in practicums because when practicums are conducted frequently, students get used to do the tasks, and soft and hard skills are developed. Someone is said to have practical competence if he/she has fulfilled the skill provided (Paryanto: 2008). Education as the media of improving the quality of students’ competences which are in accordance with the workforce requirements will, at last, provide activities which may improve the qualities of students’ competences.

The Outline of Teaching Program (GBPP) of VHS curriculum published by The Ministry of Education and Culture (1999) states that teaching and training processes in VHS consist of three programs, namely normative (16%), adaptive (29%), and productive programs (55%). The curriculum implemented in Vocational High School of Muhammadiyah 1 Bantul is the “2013 Curriculum”. It is implemented in each department of grades X, XI, and XII. The organization of VHS curriculum is designed to meet the competence standards which are set by the industry and workforce. The principles of teaching and training are developed, grouped, and organized from some subjects into normative, adaptive, and productive programs. However, some problems are found in the curriculum implementation of each department.

The problem in Muhammadiyah 1 Bantul Vocational School, especially the Machining Engineering department is related to productive practicum processes in class X. The practicums were divided into several competencies at the same time, so it requires more accuracy, supervision and assistance. Another problem is the lack of tools for practicums.

Productive practicums require a good time arrangement and sufficient laboratories. The productive practicums were conducted twice a week, and each meeting is five hours. Before the practicums were carried out, the students learnt about the introductory theory for some period of time in accordance with the time allocated by the teachers. The grade X students in the academic year of 2017 were grouped into three classes. The number of students in each class was 30-32. Because the number of laboratory and workshop tools was limited, the teachers divided each class (of three classes) into three groups in practicums.

When the productive practicums were carried out in workshops, teachers and students found some problems. The teachers dealt with problems of assisting and presenting the competences that the students should master. It was because the workshops were separated from the classrooms. Another problem is that the teachers could not identify the levels of students’ competences. The school designed a team-teaching system where activities were carried out to support productive practicums of various competencies. However, the system did not run well. Moreover, the number of materials delivered during the classes made the material delivery less optimum.

The problems were not only faced by the teachers. Students dealt with the similar problem when conducting productive practicums. They found problems in completing the practicum jobs without teachers’ assistance, and they did not pay attention to the operating procedure of tools although in fact, in practicums, students need to do a lot of work in limited amount of time.

Based on above introduction, the authors are interested in investigating the problems which are related to students’ competences in practicums of various competencies which are conducted with small groups of students. This study is aimed at examining how good the students’ competences are in the various competencies practicums which are conducted with small groups of students.

2. Method of the Study
2.1 Type of the Study
This descriptive study was intended to collect information of the process of productive practicums and the competences of grade X students of Machining Engineering department.
This study employed both quantitative and qualitative methods. In accordance with the first objective of the study of investigating the model of productive practicums, the collected data were analyzed qualitatively. Meanwhile, in order to investigate the grade X students’ competences, the data were analyzed quantitatively.

2.2 Research Setting
This study was conducted in 5th-24th February 2018. The research schedule was based on the Machining Engineering department (TP) teachers’ availabilities. This study was conducted in Muhammadiyah 1 Bantul Vocational High School located at Parangtritis Street Km.12 Manding, Trirenggo, Bantul, Special Region of Yogyakarta.

2.3 Population and Sample of the Study
X TP1, X TP2, X TP3 classes of Machining Engineering department of Muhammadiyah 1 Bantul Vocational High School consisting of 93 students and two teachers teaching productive practicums were the population of the study. Simple random sampling was used to choose the sample of the study. The samples were taken randomly in the same proportion from each class since this study was expected to be homogenous. The size of the sample was determined by a formula by Isaac and Michael. The margin of error was 5%, so the number of the sample was 75. In addition, the samples from teachers were taken by considering the number of teaching hours of both teachers.

2.4 Data, Instruments, and Data Collection Techniques
The data of this study were collected by means of observation sheets, interview guidelines, questionnaires, and documentation. The observation sheets and interview guidelines were used to find out the information related to the implementation of productive practicum model of various competencies. The questionnaires were administered to collect information of students’ activities and students’ responses to the implementation of productive practicums of various competencies. Scoring system was well determined; 1 was given for “YES” and 0 was given for “NO” answer. The list of students’ scores during one semester of productive practicums, students’ worksheets, and photographs of the practicum processes were documented.

2.5 Data Analysis Technique
Descriptive analysis was used to analyze the data in both quantitative and qualitative methods. In accordance with the first objective of the study (to find information related to learning model of productive practicums), the collected data were analyzed qualitatively. In order to find out the information of students’ competences in the productive practicums, the collected data were analyzed quantitatively.

The information of students’ competences was collected from the students’ scores during a semester. The formula used to calculate the mean score, median, mode, the highest score, the lowest score, and their percentages are presented in the following.

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\text{Percentage} = \left( \frac{\text{the scores acquired}}{\text{the maximum score}} \right) \times 100\%
\]

Teachers’ roles, students’ responses, and students’ activities were determined by dividing the data into five categories which are presented in table 1 below (NgalimPurwanto, 2013: 103).

| N  | Score                  | Category    |
|----|------------------------|-------------|
| 1  | 86% – 100%             | Very good   |
| 2  | 76% – 85%              | Good        |
| 3  | 60% – 75%              | Fair        |
| 4  | 55% – 59%              | Poor        |
| 5  | ≤ 54%                  | Very poor   |
The data analysis was based on the Miles and Huberman’s theory. It was conducted in order to investigate the practicums of various competencies. Miles and Huberman in Sugiyono (2013: 247) point out that all activities in qualitative data analysis were carried out interactively and respectively in each stage of the study, so the data were saturated.

3. Results And Discussion
The findings of the study on productive practicums of various competencies of the X grade students majoring in Machining Engineering of Muhammadiyah 1 Bantul Vocational High School were in the forms of observation sheets of teachers’ roles, students’ responses and activities questionnaires, as well as the documentation of the productive practicum students’ scores and competences during a semester. The questionnaires of students’ responses were administered in order to collect the data of students’ understanding of various competencies. Meanwhile, the student activity questionnaires were administered in order to collect information of students’ behavior and basic knowledge which support the practicums conducted in workshops.

3.1 Process and Teachers’ Role in Productive Practicums of Various Competencies
The productive practicums of various competencies is classified into some variables in accordance with the practicum procedures as shown in Figure 1.

![Figure 1. The Productive Practicum Learning Process](image)

The processes of productive practicums are explained based on the result of interviews and observation of respondents (course teachers). The collected data show that the processes of productive practicum had been designed by the teachers before they conducted the practicums. They did some activities beforehand, such as analyzing the students’ work, the formulating the outlines of learning contents, and creating students’ worksheets.

The design was documented in syllabus, lesson plans, students’ worksheets, learning media, and instruments of evaluation. The preparation stage includes the activities of: (1) preparing tools and machines for the practicums, (2) preparing the materials, and (3) preparing laboratories/workshops.

The productive practicums were divided into three groups because of the availabilities of tools and machines. The productive practicum groups make use of some hand tools (bench work), operate the grinding machines for cutting, and perform welding processes (Shielded Metal Arc Welding). The practicums with the three workgroups were conducted in the same but three different places. Therefore, teachers need to divide each class into three classes to adjust the number of tools available. In addition, teachers should manage the time, so an extensive practicum work may be done.
The time allotted for productive practicums was twice a week, and each meeting was five hours a day. According to the time allotment, the teachers used a system which managed each work group. The groups were divided based on the types of work they should finish and in accordance with the number of students. The groups consisting of 4 students worked on SMAW welding, 6 students worked on the grinding and chiseling lathes, and rest of the students did the benchwork. There was no fixed group in each semester because it may change according to students’ speed in working.

The productive practicums conducted in grade X TP in the academic year of 2017/2018 implemented “2013 Curriculum” with basic engineering subjects. The 2013 Curriculum requires teachers to design lesson plans which are according to the implemented syllabus and then they should teach based on the lesson plans. The productive practicums in this study consisted of three learning activities. They were introduction, main activities, and closing activities. The order of activities was according to the format of lesson plan which was implemented in the school.

The teachers’ roles in learning were analyzing tasks that are going to be done by the students, making the outlines of the learning contents, and creating students’ worksheets. In addition, in the preparation stage, the teachers need to: (1) prepare the tools and machines, (2) prepare practicum materials, and (3) prepare laboratories/workshops. Besides, in during practicums, as stated in the previous section, the teachers’ roles were opening the lessons, presenting the introductory theory, demonstrating, conducting productive practicums of various competencies (assisting and supervising), evaluating, giving feedback, and closing the lessons.

3.2 Students Responses to Productive Practicum of Various Competencies

The percentages of students’ responses to productive practicums of various competencies are shown in the following table.

| Activity       | Percentage |
|----------------|------------|
| Opening        | 69%        |
| Demonstration  | 88%        |
| Pelaksanaan    | 79%        |
| Umpat Balik    | 84%        |
| Penutup        | 43%        |

Figure 2 shows the students responses to the opening activity of the learning which were conducted by the teacher. The percentage of the aspect is 69%, and it is categorized as fair. The students responded fairly although the teachers managed the class well. When the teacher explained the learning objectives, the time allotment, and the scoring criteria in an easily understood way and he/she made some jokes, so the class was not boring.

Overall, the result obtained from students’ responses to the variable of demonstration done by the teachers during the teaching learning process is 88%, and it is categorized as good. Before each practicum, the teachers presented the introductory theory. It was done each morning when all students were present.

The data of the students’ response aspect are in good category (79%). 90% of the students thought that teachers were assisting and supervising them during the practicums. Therefore, many of the students could easily ask for suggestions when they had difficulties in completing their tasks. Moreover, the
result is in line with the observation of teachers’ attitude and role in assisting and supervising students during practicums.

The next variable is related to feedback. The overall data show that students’ responses to teachers’ feedback is good (84%). As shown from the observation, the teachers provided feedback for evaluating the tasks and motivating the students. 76% of the students were provided with scores, and 92% of them were only given suggestion. The result is in accordance with the evidence that all students might ask for some score when they had finished their tasks. Then, at the same time, the teachers evaluated and provided input to the students regarding the tasks.

The variable of closing activity which was carried out by the teachers is poor (43%). In the closing activity or the last sessions of practicums, the students did not actively participate in the classes. The result is in accordance with the percentage of students who did not participate in discussions which were done to reflect the teaching learning processes (39%).

Based on the explanation above, the overall percentage of students’ responses is 70%. It indicates that in general students’ responses to productive practicums of various competencies in grade X of Machining Engineering in Muhammadiyah 1 Bantul are fair.

3.3 Students’ Activities in the Productive Practicums of Various Competencies

The data of students’ activities during the productive practicums of various competencies are shown in percentages in Figure 3 below.

![Figure 3. Bar Chart of Students’ Activities](image)

Figure 3 shows the of students’ attitude. The percentage of the aspect is 93%, and it is categorized as very good. Students work performance and attitude were measured from an indicator namely work-discipline which is closely related with time management. Some routines, such as going to the laboratories/workshops and taking break during the practicums, were done as time allotted; the percentage of the aspect is 98%. However, there were still students who were late. The teachers in duty would asked the student who came late to write a statement on a note as a document which was used as the basis of evaluation.

The results of students’ work steps are categorized good (84%). The aspect included the activities of checking the practicum material (64%), following the working procedures (95%), and checking the quality of products (93%). Before completing the tasks, the students were given some tools and material for them to measure.

64% of the students measured the materials before doing the bench-work (the welding and grinding tools were not measured). Most of the students did the tasks according to specific procedures and methods which were explained by the teachers (95%) because the teachers demonstrated the procedures of benchwork, welding, and grinding before the practicums. In the middle of practicums,
the teachers might repeat the demonstrations for the students who did not understand the previous
demonstrations, so all students understood the procedures and methods well.

The aspect of tool usage is good (83%). The data of tool usage were collected by observing students
ways of selecting the main and secondary tools (88%) and following the work procedures (79%).
Before practicums, each students needed to select the tools which would help him/her in completing
the tasks. However, there were still students who could not decide which appropriate tools are (21%).
They could not decide which tools to use and what procedures to follow, for example in working with
grinding tools, they did not know how to make a component of the tools last longer. It showed the
students’ carelessness and ignorance.

The aspect of using measurement instrument usage is good (82%). The students could decide which
measurement tools for certain materials before the practicums (91%). They could measure the
thickness of an object with a caliper, making patterns on an object in a high gauge during benchwork,
and measuring the angle with a bevel protector. The percentage of the aspect of using correct measure
is 73%.

The aspect tool maintenance is very good (98%). It is due to students’ responsibilities of maintaining
the tools. The students were divided into groups which were responsible for cleaning and checking
each area of laboratories/workshops. Then, a technician would make sure that the condition, position,
and number of the tools were in place.

The aspect of work safety is very good (97%). It is a result of an agreement between the teachers and
students before practicums. The agreement was not to drop any measurement tools. If a student
dropped any, they would be punished (doing push up). Thus, the students made sure of their own
safety, other people’s safety, and the tool safety, so they would not be punished.

Based on the explanation above, the overall percentage of students’ activities is 90%. It indicates that
in general, the grade X of Machining Engineering department, Muhammadiyah 1 Bantul Vocational
High School students’ activities are very good.

3.4 Students’ Competences in Productive Practicums of Various Competencies
The students’ competences are presented in table 2 below.

Table 2. Students’ Competences during Productive Practicums

| No. | Type of Data       | Score |
|-----|--------------------|-------|
| 1   | Mean               | 81.67 |
| 2   | Mode               | 81.40 |
| 3   | Median             | 81.80 |
| 4   | The lowest score   | 79.00 |
| 5   | The highest score  | 84.60 |

Table 2 shows the data of 75 students’ competences where the highest score is 84.60 and the lowest
score is 79.00. The mean value of students’ achievement is 81.67. The competences are not only theirs
but also their teachers. Students responses and activities during the practicums play an important role.
The percentage of students’ response is 70%, and it categorized as fair. The percentage of students’
activity aspect is 90%, and it is in very good category.

Furthermore, students’ competences are influenced by scoring criteria. The teachers did not refer to
any rubric or criteria in order to avoid being subjective in scoring. It is supported by a theory by
Muhammad Akhyar (2008) that the teachers/instructors need to comprehensively take students’
personalities, students’ learning styles, and vocational competence into account in assessing students’
competences. Based on the theory, comprehensive assessment requires some indicators which are written on the scoring criteria. Hence, the results have valid basis, and the each student’s score is consistent.

The mean value of the data (81.67) indicates that generally the scores of productive practicums of grade X students majoring in Machining Engineering of Muhammadiyah 1 Bantul Vocational School is good.

4. Conclusions and Suggestion

4.1 Conclusions

The productive practicums of various competencies consist of seven steps namely opening, presenting the introductory theory, demonstrating, the productive practicum of various competencies, (welding, grinding, and bench working), evaluating, giving feedback, and closing. The teaching steps are: opening, presenting the introductory theory, demonstrating, assisting and supervising the practicums, evaluating, giving feedback, and closing. The percentage of students’ responses during the practicums is 70%, and it is categorized as good.

The students’ average score is 81.67. In general, the students’ competence level is in good category. The percentage of students’ activities during productive practicums is 90%, and it is categorized as very good. The evaluation aspects are work performance and work attitude, work procedure, tool usage, measurement tool usage, tool maintenance, and work safety.

4.2 Suggestion

The result of this study can be used as the basis of further studies which are related to evaluations of productive practicums in Machining Engineering field. The productive practicums of various competencies shall be conducted by other schools which have limited number of tools and workshops. Hence, the practicums may run well.

5. References

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