

The Competence of Graduates in Machining Technology Vocational High Schools Based on National Practical Exam in Yogyakarta, Indonesia

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Abstract This study aimed at describing the level of graduates' competence in Machining Technology Vocational High Schools (VHSs) based on 2015/2016 academic year National Practical Exam (NPE) and to see if practical courses teaching and learning facilities meet the minimum standards criteria which can be used as the input in improving learning process. The study used observation and documentation as data collection instruments. Data were collected from four (4) VHSs using observation guides and NPE results reports with 369 as the number of NPE participants and all the participants were considered. Results show that there is a lack of practical courses teaching and learning facilities because they are not proportional to the number of students, most available facilities are outdated and others are damaged. It was also found that regarding preparation scoring component all participants were into very competent category with 100%; concerning process they were into competent category with 88.82%, concerning attitudes they were into very competent category with 95.48%, concerning product they were into fairly competent category with 79.48%, concerning the time efficiency they were into very competent category with 95.39% and concerning the overall score they were into competent category with 88.49%.

Keywords: *competence, vocational high school, national practical exam*

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1. Introduction

The issue of insufficient competence is currently challenging the industrial world where novice workers experience difficulties during their first days when hired to perform a certain job. The labor force in the 21st century requires not only graduates who have high academic qualifications but it is more focused on the fact that they must be equipped with a number of skills and attributes. The world of work surveys points out that occupation-specific skills are not sufficient for graduates to meet the labor markets needs [1].

This gap is also indicated by the low absorption of VHS graduates in industries or business world. This is confirmed by the fact that regarding the VHSs graduates especial in the Special Region of Yogyakarta only 70 % were absorbed in the world of work in 2017 while the others are jobless [20]. It shows that it will not be easy to meet the target of the Directorate of VHSs 2015-2019 as it was ideally planned that 93% of VHSs graduates can get jobs in their respective fields of study by the year 2019. Previous research found that this is caused by curricula that are not in accordance with the labor market needs, outdated machine tools and equipment, and insufficient learning infrastructures [2]. So there is a need of raising

up the level of VHSs graduates absorption in the world of work by increasing their professional competence [18,19].

To date, the level of competence of VHS especially in Machining technology graduates is not known yet even if its insufficiency is reflected in employers' complaints and high unemployment rate. The competence in question is related to hands-on skills even though soft skills would not be put aside. In Machining Technology VHSs hands-on skills competencies are acquired in machining process courses (practice courses) and measured in Vocational Practice Exam [3]. In vocational education practical courses have a very important and strategic position to prepare graduates who meet the industrial labor market needs. Therefore, the course of practice is considered as the main one in vocational education. Thus, vocational education can actually produce graduates who are ready to work, required to always improve the quality of practical courses teaching and learning process, either in the workshop or in the laboratory [4].

Machining Technology expertise program trains students for mainly becoming machinery tool operators. So far, referring to the Indonesian ministry of industries, it seems like the imports of machinery tools related goods have been increasing since 2010 up to 2015 comparing to exports. In 2010 the cost of machinery tools imports was 480 million USD whereas the value of imports was 100 million USD, in 2011 the imports' cost was 770 million

USD whereas the value of exports was only 50 million USD, in 2012 the cost of imports was 500 million USD whereas the value of exports was below 50 million, in 2013 the imports were 700 million USD, in 2014 the cost of imports was 1.3 billion USD while the value of exports was only 10% and in 2015 the cost of imports was 1.5 billion [5]. This information can allow saying that there is a need of competent machinery tool operators as the number of machinery tool equipment increases, the number of machinery tools operators should also increase.

The Competence in Vocational Education is much related to the performance of an individual when carrying out job responsibilities. It is in that sense it is said that in VET, people are considered competent when they are able to consistently apply their knowledge and skills to the standard of performance required in the workplace [6]. In today's education, competence is needed especially when it comes to measuring learning process outputs and outcomes. It is in that sense the competence is considered as keyword in today's world of education [7]. It reflects a major paradigm shift in our way of looking at a person whom we consider civilized, educated and able to play a useful role in our modern society. Competence basically focuses on the outcomes which means what a student/graduate can do rather than what he may have studied within time-based educational training.

Furthermore, competence can be defined as the knowledge, skills and behavior to be acquired by learners [8]. The competence also consists of personality, motivation, attitudes and values [9]. This shows that competency becomes a very important thing in the achievement of a particular job. This is in accordance with competence statements which define predictable outcomes from the performance of professionally related functions, knowledge, skills and attitudes considered to be essential for performing those functions [10].

Based on the background and concept of competence, it is obvious that the quantity, conditions of machine tools teaching facilities and the level of competence need to be known. As the majority of VHSs graduates are not employed, there is a need to identify the real cause of that non employment especially for machining technology expertise program. The purposes of this study were; firstly to determine if the available practical courses teaching and learning facilities meet the minimum standard criteria and secondly to describe the level of graduates' competence in Machining Technology Vocational High Schools(VHSs) based on 2015/2016 academic year National Practical Exam (NPE).

2. Research Methodology

This study used a descriptive method. Data were collected from four (4) public VHSs having machining technology expertise in Yogyakarta Province, Indonesia using observation guide and documentation instruments. The observation guide was validated through expert judgement by experts in Vocational Education while documentation was used to collect the NPE results from each school. The schools used in the study are: *SMK Negeri 2 Depok*, *SMK Negeri 3 Yogyakarta*, *SMK Negeri 2 Wonosari* and *SMK Negeri 2 Pengasih*. The study adopted total population sampling technique [11] because

the results of the all 369 NPE participants were considered. The observation in this study was used to determine the quantity and conditions of practical courses machine tool facilities whereas documentation gathered the information about related literature and 2016 NPE results.

Table 1. VPE results data analysis criteria

No	Performance Intervals	Categories
1	$X \geq 90\%$	Very Competent
2	$80\% \leq X < 90\%$	Competent
3	$70\% \leq X < 80\%$	Fairly Competent
4	$X < 70\%$	Fail

The Table 1 shows data analysis criteria which was fixed based on the NPE assessment sheets competence achievements categories [11] (*Lembar penilaian Ujian Praktik Kejuruan* in Indonesian language). NPE assessment classifies performance into four categories, X in Table 1 stands for obtained scores.

3. Results and Discussion

3.1. The Description of Data about the Number and Conditions of the Practice Teaching Facilities

The available facilities include both good and damaged machines, machines in good conditions are the ones which can operate. These machines are useful in teaching practical courses and tests/exam. Damaged machines are the ones which cannot function, means that they need a repair to operate or replacement. Table 2 shows how many machines and equipment are in working conditions, machines that are not in operating conditions and those used during the practice test; the numbers are presented accordingly.

The required minimum standards criteria for practice courses facilities in Machining Technology VHSs according to the Regulation of the Minister of National Education Number 40 the Year 2008 were presented on the basis of expected competencies to be mastered by graduates. Concerning Machining Technology VHSs, this regulation put emphasis on standards of facilities at bench work area, metal measurement and testing room, turning (lathe) machines working area, milling machines working area, grinding machines area, fitting works area and storage and instructors rooms.

3.1.1. Description of 2015/2016 VPE Results

In this research, the 2015/2016 Vocational Practical Examination results in Machining Technology expertise program were analysed. The analysis was done considering all the five scoring components of assessment during the NPE implementation [12]. Table 3 represents the description of 2015/2016 NPE results which displays the range, minimum and maximum score, mean, and standard deviation for all the scoring components and for the overall score. Based on the results of analysis in Table 3 using IBM Statistical Package for Social Sciences (SPSS) program application Version 22, the following results were obtained: the value of range, minimum score,

maximum score, mode, mean and standard deviation. The value of range indicates as the difference between the maximum score and minimum score for each component, the value of mode shows the score that occurs most often within a set of scores for each component, the value of mean indicates the average of all scores for each component, and the value of standard deviation indicates the measure of dispersion of a set of scores from its mean for each component. A lower standard deviation shows that the scores points tend to be closer to the mean of the set of scores for each component, whereas a higher standard deviation shows that the scores are spread out over a wider range of values from their mean.

From the means in Table 3 the competence categories considering can be known. In regard to preparation all participants were very competent with 100%, process they were competent with 88.92%, attitudes they were very competent with 95.39%, product they were fairly competent with 79.48%, time they were very competent with 95.39% and considering the overall score they are in competent category with 88.49%.

Data about machine tools in Table 2 show that the available machine tools meet the minimum standards criteria as recommended in the Regulation of the Indonesian government regulation of the National

Education Number 40 the Year 2008 concerning the standard of facilities and infrastructure which require at least a VHSs to have eight (8) turning and four (4) milling machines [13]. It is very important to know that this criterion was fixed for the class of 32 students but the number of students in the 2015/2016 academic year was 93 for SMK Negeri 2 Wonosari, 125 for SMK Negeri 3 Yogyakarta, 60 SMK Negeri 2 Depok and 91 for SMK Negeri 2 Pengasih. As the number of students exceeds the allowed number of students by the minimum criteria was fixed it seems like the number of available practical courses teaching machine tools was not proportional to the number of students. It means that they are against the new and the updated rule about the allowed number of Students for one class as it is recommended by the Indonesian regulation of the ministry of education and culture in its chapter five verses 25 and 26 saying that for VHSs the minimum number of students per class is 15 whereas the maximum is 36 [14]. It should also be noted that the recommended teaching facilities in the are the minimum it would be better in case they are even more to facilitate practice teaching and learning process. Thus, this outdated and insufficiency of practice teaching facilities lead to difficulties when it comes to the preparation of workplace-oriented graduates [15].

Table 2. The number and conditions of the available practice teaching facilities in VHSs

No	Names of Vocational High Schools	Types of Machines	Available facilities			
			Quantity and conditions			
			All	Good	Damaged	Required by MSC
1	SMK Negeri 2 Depok	Lathe machines	18	15	3	8
		Milling machines	6	5	1	4
		Pedestal grinder	3	3	-	4
		Boring machines	6	6	-	Not specified
2	SMK Negeri 2 Pengasih	Lathe machines	23	18	5	8
		Milling machines	7	6	1	4
		Pedestal grinder	4	4	-	4
		Boring machines	2	2	-	Not specified
3	SMK Negeri 3 Yogyakarta	Lathe machines	20	20	-	8
		Milling machines	8	8	-	4
		Pedestal grinder	8	8	-	4
		Boring machines	-	-	-	Not specified
4	SMK Negeri 2 Wonosari	Lathe machines	17	12	5	8
		Milling machines	10	10	-	4
		Pedestal grinder	4	4	-	4
		Boring machines	4	4	-	Not specified

Table 3. 2015/2016 VPE results descriptive analysis

	Preparation	Process	Attitudes	Product	Time	Overall_Score
N Valid	369	369	369	369	369	369
N Missing	0	0	0	0	0	0
Mean	100	88.92	95.44	79.48	95.4	88.49
Mode	100	100	100	80.63	100	86.69
Std. Deviation	0	10.90	8.74631	9.09	20.9	4.99
Range	0	25.00	40.00	48.48	100	25.19
Minimum	100	75.00	60.00	51.52	0	74.81
Maximum	100	100	100.00	100	100	100

The tasks to be performed by machining technology expertise program graduates require to be familiar with machine tools. The responsibilities to be carried by machine tool operators are (1) maintaining the safe work environment, (2) maintaining the machine tools (3) analyzing the blueprint, (4) performing the machining process, and (5) cleaning machine tools, tools, and the workplace [16]. VHSs have to avail enough practical courses teaching facilities so that students can acquire skills matching with the skills required by the world of work.

The Table 4 and Figure 1 shows how scores of each scoring components are distributed into performance categories in term of percentages (%).

NPE assesses which need to be differentiated one from the others. Firstly, it assesses preparation which focuses on how students do the inspection of materials and tools set up. Secondly, it assesses process which pays attention to the application of the principles of occupational safety and health in the work environment, the use of hand tools, the use of measuring instruments, reading drawing, operating lathe and milling machines. Thirdly, it assesses attitudes which put emphasis on workplace safety, discipline, responsibility, carefulness, and initiative. Fourthly, it assesses the quality of the product, which put emphasis on dimensions accuracy and tolerances of machined product. Finally, it assesses the time efficiency by allocating the completion time, it takes account on if the student finished his/her job before/at/after the

allocated time. Among the scoring components, marks are not distributed equally but all the time product aspect carry higher marks; the reason behind is that the world of work prioritizes the quality of the product.

Table 1 presents performance categories according to the Vocational Practical Exam sheet. The two first categories (Very Competent and Competent) are the ones recommended by the industrial world; it means those who can get above 80%. The third category (fairly competent) includes those who have the score which falls in the range of $70\% \leq X < 80\%$; graduates in this category only get school certificate. The last category is for those who couldn't get the cut of score; these are required to repeat. The Figure 1 can help to easily understand the performance of NPE participants.

Looking closely on the Figure 1, it is clear that product scoring component by which VPE participants are few into very competent category with 16.50% and many into fail category with 16.30%. The other components that participants failed are the time efficiency with 4.60% and attitudes with 0.8% of all participants.

The above description and analysis allowed the researcher to prove the reason behind the aforementioned problems related to the low skills among VHSs' graduates. The shortage and the outdated practical courses teaching facilities among schools is the main factor of failure concerning product and time scoring components. This finding is supported by that of [17] that VHS that has complete facilities impact on the pattern of implementation of learning.

Table 4. Scores distribution among performance categories according to scoring components

P.C \ S.C	Preparation	Process	Attitude	Product	Time	Overall Score
Very Competent	100	54.5	78.2	16.5	95.4	33.3
Competent	0	10.8	20.9	36	0	61
Fairly Competent	0	34.7	0	31.2	0	5.7
Fail	0	0	0.8	16.3	4.6	0

P.C: Performance Category and S.C: Scoring Component.

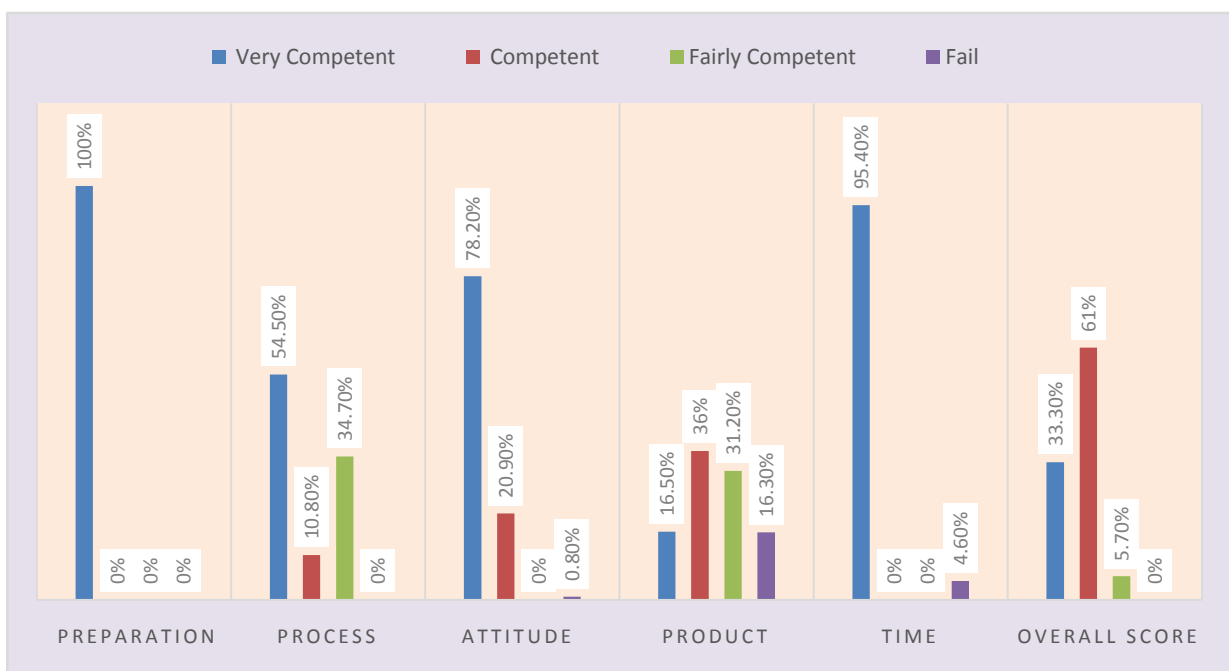


Figure 1. Presentation of scores into performance categories with respect to scoring components

4. Conclusions

The professional competence for Machining Technology VHSs graduates is measured through the National Competence Exam which consists of Theory and Practical Exams. Practical Exam measures the ability of students to work with machine tools. The research came up with showing that the number of available practical courses teaching and learning facilities are not proportional to the number of students; most of those facilities are outdated whereas other are damaged in the way they cannot be used during the teaching process.

It was also found that regarding preparation scoring component all participants were into very competent category with 100%; concerning process they were into competent category with 88.82%, concerning attitudes they were into very competent category with 95.48%, concerning product they were in fairly competent category with 79.48%, concerning the time they were into very competent category with 95.39% and concerning the overall score they were into competent category with 88.49%.

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