The analysis of machining job risk in vocational workshop

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Abstract. This study was purposed to identify the hazards that might occurred in the machining workshop of Public VHS of 2 Wonosari, identify the probabilities that might occurred in machining workshop of Public VHS of 2 Wonosari, identify the risks that would occur in machining workshop of Public VHS of 2 Wonosari, and recognize how the workshop management, teachers and schools controlled and prevented the risks in the machining workshop, in order to avoid the accidents in the machining workshop of Public VHS of 2 Wonosari. This research was descriptive. Data was obtained through observation, interviews and photographic documentation of machining workshop conditions. The validity of the data was done by testing credibility, dependability and confirmation test. Data analysis was using Miles and Huberman analysis methods, by reducing data, presenting data and drawing the conclusions or verification. The results of the study proved that there were 29 hazards sources which identified in the machining workshops, there were 30 opportunities probability which identified in the machining workshop, there were 31 risks which identified in the workshops if without accurate treatment, and the average of risk control in the machining workshops was 86.0%.

1. Introduction

The social paradigm of vocational education development as economical since vocational education has a significant role in developing modern industry and improving the quality of life of the community [1]. The vocational high school (VHS) aims to improve the skills of students becoming job-ready workforce candidates. Referring to this, the practical activities in the practice workshop have a crucial role in developing students' skills as provisions for working in the industrial world [2].

Vocational High School (VHS) is closely related to the workshop. A workshop is an excellent tool used to carry out practices learning processes and also apply the theory provided. A good workshop must meet several indicators including having sufficient area, easy transportation access for material delivery, adequate lighting, have space-related to workshop equipment such as technician room and equipment room and warehouse for storing goods for practice, and having personal protective equipment (PPE). PPE is equipment used by employees to protects themselves against potential workplace hazards. PPE is a tool that must be used when working by work hazards and risks to maintain the safety of workers themselves and those around them [3].

VHS 2 Wonosari, especially machining techniques, has fulfilled the Occupational Health and Safety aspect, including a study of potential risks and standard operating procedure (SOP) for risk control in the workshop. Risk is a measure of the likelihood of loss that will arise from a particular source of danger that occurs, to determine the risk requires a calculation of the consequences (impacts) that may arise or the probability, which is often referred to as the level of risk [4]. However, of all the aspects of occupational health and safety in the machining workshop of Public VHS of 2 Wonosari,
several aspects have not been fulfilled, including there is no list of risks of using machines, irregular arrangement of material warehouse and the absence of a list of risk controls that may occur in the workshop.

Students also become one of the obstacles or even become a source of risk in the machining workshop at Public VHS of 2 Wonosari. Based on these observations and research found that many students work without regard to standard operating procedures. Also, more than 50% of students do not use PPE when practising. This happens because many students do not know about the importance of occupational health and safety, even though teachers and technicians often remind them.

Unsafe conditions and not wearing PPE can raise the risk of a minor accident, major accident or fatal accidents. To prevent the occurrence of work accidents, it is necessary to add an Occupational Health and Safety program. Occupational health and safety (OHS) refers to the health aspect of the workplace and work environment. Admittedly, work safety can improve the efficiency of work performance and productivity [5].

The purpose of OHS is to maintain the health and safety of the work environment. OHS also protects co-workers, workers’ families, consumers, and others who may be affected by work environment conditions [6]. Besides, the purpose of risk management is to secure a system of activities/work starting from input, process to output. The activity in question can be in the form of production or maintenance or maintenance activities in the machining workshop at Public VHS of 2 Wonosari. The OHS program is expected to reduce the level of work accident risk at the workshop.

Risk control also needs to be done in order to reduce the risk of work accidents in the machining workshop of public VHS of 2 Wonosari. This risk control has been carried out by schools, teachers and workshop management including the application of standard operating procedures and the use of PPE. Based on the description above, it is necessary to have a study of the risks of machining jobs in public VHS of 2 Wonosari.

2. Methods
This type of research about job risk analysis machining in machining workshop at public VHS of 2 Wonosari is descriptive quantitative research. The research describes a situation/phenomenon in detail and puts more emphasis on answering the question how and who [7]. So this study does not compare one variable with another variable but only compares with existing and valid theories.

Consideration in the selection of this type of research is due to research issues about risk and how to control it, so that a complete, valid, credible and in-depth research data is needed in order to obtain useful results. So that the research carried out can be useful and can be justified. This research was conducted to obtain accurate data and information about the risks in the machining workshop and how to control them, so it is necessary to determine the research respondents who are the subject of the study. Through this research, it is hoped that the information obtained by the researcher can be made into accountable data. In this study, the research subjects include the head of the study program, a teacher and a technician. In addition, respondents or other informants are the students of class XI MA machining techniques.

The research procedure consists of preparation which includes, conducting a place of observation before research, making proposals, making research instruments, taking care of research permits, as well as determining populations and samples. The research includes conducting interviews with the head of the study program, filling in the teacher questionnaire and workshop management and student observation questionnaires as well as documentation. Furthermore, the results of the study were analysed based on predetermined benchmarks, then make conclusions. Research data were collected by interview, observation and documentation. Interviews are used to obtain information or data about the risks of machining jobs. Observations were made using a checklist. This checklist is used by researchers to obtain information about the risks that exist in the machining workshop. The document used to obtain data for this study is a list of engine maintenance history.

Data analysis is the process of systematically searching and compiling data obtained from interviews, field notes and other materials so that it can be easily understood. Data analysis is done by
organising data, describing it in units, synthesising, composing into patterns, choosing what is essential and what will be learned, and making conclusions that can be shared with others [8]. The data analysis technique used in this study is the analysis of Miles and Huberman data models. The data obtained needs to be clearly explained by the problem and research objectives.

Reduction of data from observations and interviews are categorised into four categories: hazard, probability, concentration and exposure. Then the second data reduction is made, namely hazard, probability, risk and risk control. Workshop condition data were analysed regarding the risks of machining work.

Furthermore, the data presented are in the form of indicators and variables, risks and potential incidents, risk level and risk control that have been carried out. Then conclusions are obtained in the form of an object and calculation of the level of risk that was previously not yet real so that after investigation it becomes clear and specific, it can be a causal or interactive relationship, hypothesis or theory.

3. Result and Discussion

3.1. Analysis Lathe machining

In detail, the hazards, probabilities and risks that exist in a lathe machining workshop are shown in Figure 1. Based on Figure 1, the hazard that occurs in lathe machining is equal to 94%. This can happen because the research instruments from the hazard source are made based on the findings when making observations at the lathe machining workshop before doing the research. Out of 17 items identified by hazard in the machining workshop of public VHS of 2 wonosari, 16 items are classified as a source of danger that can allow work accidents both minor accidents and major accidents. However, the hazard will be safe or not dangerous if the handling is carried out by the school; the workshop is done properly. Also, students whom practice lathe machining use personal protective equipment (PPE) that has been provided by the school.

![Figure 1. Hazard, probability and risk in lathe machining workshop](image)

The risk probability that exists in lathe machining workshop is 100%. From a total of 17 observations made at the lathe machining workshop, all have the potential to pose a risk. However, from all opportunities for these risks can be minimised and even eliminated by handling and implementing standard operating procedures following risk control. While the risk of machining work in a lathe machining workshop is 100%. From all data taken based on the observation sheet, all samples are a risk if not handled properly.
Based on Figure 2, the teacher checklist, from an average of 3 respondents risk control based on workshop handling, SOP implementation and the availability and use of PPE. From a total of 36 checklist items for each respondent, a total of 89 items of risk have been prevented or controlled. From these figures, we can calculate that of the total 108 items in the checklist, as many as 89 items in the safe or preventable list are risky. In other words, risk prevention based on the teacher checklist is 82.4%.

Based on the observation sheet taken from the behaviour and risk control conducted by students of class XI MA2, there are 15 students from a total of 18 observation items obtained 222 items classified as not at risk or can be controlled. Retrieval of data is taken based on student behaviour in the workshop and the use of PPE. Of the total 270 items, 222 items are not risky or can be controlled. It can be calculated that based on the observation of students in the machining workshop at public VHS of 2 wonosari, that the risk control is 82.2%.

Based on the results of the observation of risk control between the teacher's checklist by 82.4% and the results of the student observation sheet by 82.2%, the average risk control obtained at the lathe machining workshop is 82.3%. This value is included in the top category for the value of risk control. From this value, it can be concluded that the lathe machining workshop at public VHS of 2 Wonosari is categorised as safe for the risk of lathe work.

3.2. Analysis Milling Machining

Based on Figure 3, the hazard in the milling machining workshop of public VHS of 2 Wonosari is 76.4%. This value is smaller than the hazard in the lathe machining workshop. In the milling machining workshop out of a total of 17 observations, there were 13 items classified as a hazard. While 23.6% of the items from the study that were not classified as a source of danger include noise, storage of salt, safety of the arbour and chisel as well as the provision of parallel strips of various sizes to prop objects to be safe and robust.
The probability in a frais machining workshop at Public VHS of 2 Wonosari is 76.4%. This value is smaller than the probability in the lathe machining workshop. In the milling machining workshop, out of a total of 17 observation points, 13 items are classified as a probability. While the risk of machining jobs in machining workshops of Public VHS of 2 Wonsari is 82.3% of the total 17 observation items. This value is smaller than the risk in the lathe machining workshop at Public VHS of 2 Wonosari.

![Milling Machining Risk Control](image)

**Figure 4. Risk control of milling machining workshop**

Based on the pictures, we can compare the results of the teacher's checklist with the results of student observations which show that both of them show results that show a slight difference of around 6%. This shows that there is a difference between the teacher's checklist and the student observation sheet which shows a difference of 6%. The difference occurs because of the incompatibility of the self-protection tool that has been provided by schools with the use of students because there are still many students who do not use PPE even though the school has provided it. Among them are the use of goggles when refraction with high rotation or large feeding and the use of masks when cleaning. Besides there are still many students who work without regard to the SOP set by the school.

Based on the research data, there is a risk-based on teacher observation that is 7.30% while based on student observation sheets 13.30%. It can be concluded that the average risk in a milling machining workshop is around 9.30% with the risk of wearing glasses when sharpening, sharp objects, light intensity and storage of broth.

With the results of the risk control between the teacher checklist of 92.7% and the results of the student observation sheet of 86.7%, the average risk control obtained at the milling machining workshop is 89.7%. This value is tremendous in the category of risk control in the machining workshop. This value is included in the excellent category for the value of risk control. From this value, it can be concluded that the milling machining workshop of public VHS of 2 Wonosari is also categorised as safe for the risk of milling work.

4. **Conclusions**

Hazards identified if without the use of PPE in the machining workshop of public VHS of 2 Wonosari are 29 hazards, amounting to 85.2%. Probability identified without handling and applying SOP in the machining workshop of public VHS 2 Wonosari totalling 30 risk opportunities is equal to 88.2%. The risks identified due to the lack of students' understanding of OHS are 31 risks, amounting to 91.1%. Risk control in the machining workshop of public VHS of 2 Wonosari is 82.3%. These values are categorised as very good. Risk control in the milling machine shop of public VHS of 2 Wonosari is equal to 89.7%. These values are categorised as very good. Workshop management should reduce the level of risk in the machining workshop of public VHS of 2 Wonosari both in lathe and milling machine, reduce the danger or hazard in the workshop and can manage for risk control so that the risks in machining workshops, both lathe or milling can be minimised again. The teacher helps the
workshop management to reduce the hazard, the level of risk and in risk control and always reminds students always to pay attention to SOP and use PPE.

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