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WORK SAFETY ANALYSIS WITH JOB SAFETY ANALYSIS (JSA) IN LECTURE ACTIVITIES AT THE POLITEKNIK GAJAH TUNGGAL WORKSHOP

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Abstrak

Penelitian ini bertujuan mengidentifikasi langkah kerja yang aman, identifikasi potensi bahaya, dan tindakan pencegahan terhadap aktivitas perkuliahan di Workshop Politeknik Gajah Tunggal menggunakan metode Job Safety Analysis (JSA). Workshop yang menjadi pusat pembelajaran praktik menghadapi berbagai risiko keselamatan, seperti dari alat kerja, bahan kimia, hingga kondisi lingkungan. Observasi dilakukan pada lima proses utama: bubut, las, gerinda duduk, gerinda tangan, dan milling. Proses observasi menghasilkan temuan 35 potensi bahaya. Bahaya ini diantisipasi melalui langkah pengendalian seperti penggunaan alat pelindung diri (APD), perbaikan teknis, dan pengelolaan administratif. Langkah-langkah ini digunakan untuk menciptakan lingkungan belajar yang lebih aman, meningkatkan kesadaran akan pentingnya keselamatan, serta mendukung proses pembelajaran yang optimal.

Kata kunci: *Hazard, Job Safety Analysis, Workshop.*

Abstract

This study aims to identify safe work steps, identify potential hazards, and preventive measures against lecture activities in a single elephant polytechnic workshop using the Job Safety Analysis (JSA) method. Workshops that are the center of practice learning face various safety risks, such as from work tools, chemicals, to environmental conditions. Observation was carried out in five main processes: Lathe, Las, Sitting Grinding, Hand Grinding, and Milling. The observation process produces 35 potential hazards. This danger is anticipated through control steps such as the use of personal protective equipment (PPE), technical improvement, and administrative management. These steps are used to create a safer learning environment, increase awareness of the importance of safety, and support the optimal learning process.

Keywords: *Hazard, Job Safety Analysis, Workshop.*

1. INTRODUCTION

Workshop is the main facility in vocational education institutions that are used to train students in having technical skills that are in accordance with industrial needs (Sari et all, 2024). As a place of learning

based on practice, workshops have a high risk of potential hazards that can threaten the safety and health of all users, including students, lecturers, and supporting staff (Kurnianingtyas, 2022). These dangers can come from various sources such as work tools, machines with moving components, hazardous chemicals, or inadequate work environment conditions (Murdiyono, 2016). In this context, the implementation of in -depth Hazard identification is very important to prevent accidents that can harm many parties. This has never been done at the Gajah Tunggal Polytechnic Workshop. One method that has proven effective in managing work risk is the Job Safety Analysis (JSA). This method allows detailed analysis of each stage in work activities, so that the potential hazards can be identified and appropriate control steps can be formulated before the work begins. The purpose of using the Job Safety Analysis (JSA) method is to identify the potential hazards in each work activity so that workers at work can be guaranteed work safety and health (Abidin and Mahbubah, 2021). Job Safety Analysis not only helps reduce the risk of work accidents, but also increase awareness about the importance of safety among students and educators. Job Safety Analysis can also be interpreted as an examination whether a job goes according to the SOP set by the company (Ikhsan, 2022). The purpose of the Job Safety Analysis (JSA) is to identify and assess all risk elements associated with a task, so that the steps to eliminate or control the danger can be applied (Kjellén and Albrechtsen, 2017). Meanwhile, according to Glenn, Job Safety Analysis refers to the analytical process to develop safer work procedures and documents produced from the analysis (Glenn, 2011).

In the Gajah Tunggal Polytechnic, Workshop is an important element in lectures that are the center of practical learning. However, the high intensity of the use of this facility makes it vulnerable to work accidents if the potential danger is not identified and managed properly. For example, the risk of injury due to the use of machines that do not follow procedures, exposure to chemicals that are not handled properly, or fatigue due to work positions that are not ergonomic. The effort to prevent this is to apply a concept of occupational safety and health (Wijaya, 2022). In these conditions, the application of the JSA method is very relevant because it can identify risks at each stage of lecture activities, starting from the preparation stage to completion of work (Saraswati et all, 2019). This study aims to identify the potential hazards contained in lecture activities in a single elephant polytechnic workshop using the Job Safety Analysis (JSA) method and provide recommendations for control steps that can improve work safety and create a safer learning environment. Job Safety Analysis is a comprehensive approach in identifying, analyzing and formulating improvement steps to minimize hazard risk in work (Ilmansyah et all, 2020). Through the application of the Job Safety Analysis (JSA), it is expected that a work culture will be formed that prioritizes safety, so as to support the achievement of optimal learning objectives (Abidin and Ramadhan, 2019).

2. METHOD

Data was collected through observation in a Gajah Tunggal Polytechnic Workshop. This study uses the Job Safety Analysis (JSA) method. Job Safety Analysis (JSA) is a method for identifying work steps, and potential hazards to be evaluated in determining the right control (Ilmansyah et all, 2020). The benefit of Job Safety Analysis (JSA) is that it can protect workers when doing a job in the field. The Job Safety Analysis process includes three main stages (Rozenfeld et all, 2010)

1. Identification - Choosing a particular job or activity and breaks it into a sequence of work stages, then identifying all possible incidents of loss of control that can occur during work.
2. Assessment - Evaluating the relative level of risk for all identified incidents.
3. Actions-control risk by taking enough steps to reduce or eliminate them.

3. RESULT

Based on observations of activities at the Gajah Tunggal Polytechnic Workshop, five work process stages were selected to be identified using the Job Safety Analysis (JSA) method. These five processes are the main processes in this workshop: welding, hand and bench grinding, milling, and turning. Each process stage is divided into three parts: job preparation, operational processes, and finished work.

Table 1. Job Safety Analysis Welding Operation

Job Safety Analysis	
Job Title: SMAW	Date: 28 November 2024
Location: *Workshop*	Section: Operasi Las

Personal Protective Equipment Used: Welding Helmet & Goggles, Welding Gloves, Safety Shoes, Respirator Mask, Welding Apron/Welding Jacket.			
No.	Description of Work Steps	Potential Hazards	Precautions Analysis Results
A.	**Job Preparation**		
1.	Installing the welding arc	Sparks and excess molten metal can occur if the welding is incorrectly installed	Adjusting the welding clamp properly and setting the correct arc length.
2.	Turning on the SMAW welding machine	Users are electrocuted or electrocuted	Proper installation of the ground cable and starting the engine with dry hands
		Explosion due to error in grounding	Good ground cable installation.
B.	**Operation Process**		
1.	Operating SMAW Welding	Light radiation (UV and IR)	Use personal protective equipment (PPE) such as welding helmets & glasses, welding gloves, safety shoes, welding aprons/welding jackets.
		Hazardous Smoke and Gases	
		Flying Particles (Slag and Metal Flakes)	Use personal protective equipment (PPE) and keep a safe distance from others while working.
		Tersandung kabel listrik Las SMAW.	Stumbled on SMAW welding power cable.
		Non-ergonomic working posture	Apply ergonomic work techniques.
		Hands electrocuted and burned due to the flow in the material	Use personal protective equipment (PPE) when handling materials being welded or joined.
2.	Setting the Welding work angle	The welding arc slips from the material, pointing towards the operator.	Good welding techniques according to SMAW welding guidelines and ensure stability while working.
C.	**Completed work**		
1.	Turning off and storing SMAW welding	Holding a SMAW welding tool that is still hot after use	Make sure the tool is cool before storing, and place it in a safe location.

Based on Table 1, hazard identification in SMAW welding work includes various potential hazards such as sparks, UV and IR light radiation, smoke and hazardous gases, flying particles, and the risk of electric shock and explosion due to improper grounding. Each potential hazard must be anticipated with preventive measures, such as the use of personal protective equipment (PPE), ergonomic work technique settings, and ensuring the condition of tools and cables are in a safe condition. The prevention stage also prioritizes safety procedures, starting from preparing to install the welding arc to storing the welding equipment after use. Figure 1 below shows the SMAW welding process.

Figure 1. Work Process with SMAW Welding.

Table 2. Job Safety Analysis of Hand Grinder

Job Safety Analysis			
Job Title: Gerinda		Date: 28 November 2024	
Location: Workshop		Section: Hand Grinder	
Personal Protective Equipment Used: glasses, face shields, and gloves,			
No.	Description of Work Steps	Potential Hazards	Precautions Analysis Results
A.	**Job Preparation**		
1.	Grinding wheel installation	Hand injury, improper installation	Use gloves, install with a special key according to the procedure.
2.	Electrical cable inspection	Damaged cable, unsafe connection	Check the condition of the cable before use, avoid peeled cables.
B.	**Operation Process**		
1.	Grinding operation	Grinder slips, sparks, material is thrown	Use complete PPE: goggles, face shield, gloves, maintain a stable position.
2.	Cutting/smoothing	Sparks, metal fragments	Keep away flammable materials, use face shield and work clothes
3	Examination of work results	Hot surfaces, metal chips	Wait for cooling, use heat resistant gloves
C.	**Completed work**		
1.	Tool storage	The tool is still hot, cables are scattered	Cool the tool before storing, tidy up the cables and store in a safe place.

Based on Table 2, hazard identification in hand grinding work includes potential hazards such as loose grinding wheels, sparks, thrown material, and electric shocks due to damaged electrical cables. Other hazards include hand injuries when installing grinding wheels and the grinder slipping during operation. Each risk has been anticipated through precautions, such as using personal protective equipment (PPE) in the form of goggles, face shields, and gloves, ensuring the grinding wheels are installed with a special key, and maintaining stability while working. This work stage also emphasizes safety procedures, from installing the grinding wheels to storing the tool in cool

conditions and a safe location..

Table 3. Job Safety Analysis Grinding Machine

Job Safety Analysis			
Job Title: Grinder		Date: 28 November 2024	
Location: Workshop		Section: Grinding machine	
Personal Protective Equipment Used: glasses, face shields, and gloves,			
No.	Description of Work Steps	Potential Hazards	Precautions Analysis Results
A.	**Job Preparation**		
1.	Initial examination	Grinding stone broken, machine condition damaged	Check the condition of the machine and grinding stone before use.
2.	Installation of guards	No protection during operation	Make sure the guard is properly installed before starting the machine.
3.	Work area	Dirty work area, distractions while working	Clean the work area before starting work
B.	**Operation Process**		
1.	No-load test	The machine is unstable when operating	Perform a no-load test to ensure machine stability.
2.	Machine operation	Sparks, metal fragments, thrown materials	Use complete PPE: glasses, mask, gloves
C.	**Completed work**		
1.	Engine stoppage	The machine is still running when it is cleaned or moved.	Wait for the grinding wheel to stop completely before cleaning or moving it.

Based on Table 3, hazard identification in work using a grinding machine includes various potential hazards, such as the breaking of the grinding wheel due to damaged machine conditions, injuries from sparks and metal fragments, and the risk of accidents while the machine is still rotating. Each potential hazard is anticipated through precautions, including checking the condition of the machine and grinding wheel before use, ensuring the installation of guards, and using personal protective equipment (PPE) such as goggles, masks, and gloves. In addition, the work area must be cleared to avoid interference, and the machine needs to be tested without load to ensure stability. Safety procedures are also implemented at the final stage, such as waiting until the grinding wheel has completely stopped before cleaning or moving the machine.

Table 4. Job Safety Analysis Milling Machine

Job Safety Analysis			
Job Title: Miling		Date: 28 November 2024	
Location: Workshop		Section: Milling Machine	
Personal Protective Equipment Used: glasses, face shields, and gloves,			
No.	Description of Work Steps	Potential Hazards	Precautions Analysis Results
A.	**Job Preparation**		
1.	Initial engine inspection	Cable is damaged, machine condition is not suitable	Check the condition of the machine and cables before use.
2.	Installation of workpieces	Hands are stuck, workpiece is unstable	Use a clamping tool, make sure the workpiece is properly installed.
3.	Chisel position setting	Chisel not installed	Install the chisel carefully and

		properly	according to procedure
B.	**Operation Process**		
1.	Machine operation	Metal fragments, ejected material	Use PPE: glasses, gloves, and maintain a safe body position.
2.	During the milling process	Feet hit the machine, body position is not ergonomic	Keep a safe distance from the machine, adjust the working position ergonomically
C.	**Completed work**		
1.	After milling is complete	The workpiece is hot, the machine is still running	Turn off the machine before removing the workpiece, use heat-resistant gloves
2.	Tool storage	Tools stored carelessly	Store the tool in a safe place after the engine is turned off.

Based on Table 4, hazard identification in manual milling machine work includes potential hazards such as broken chisel bits, flying material, metal fragments that cause injury, and the risk of electric shock due to damaged cables. Other hazards include hands being caught during workpiece installation, feet being hit by the machine, and injuries from handling hot workpieces. Preventive measures are taken by ensuring the chisel bit and workpiece are properly installed, using personal protective equipment (PPE) such as goggles and gloves, and maintaining a safe body position while working. Safety procedures include checking the condition of the machine, carefully adjusting the chisel position, and ensuring the machine is turned off before removing or storing equipment in a safe place.

Table 5. Job Safety Analysis Lathe

Job Safety Analysis			
Job Title: Lathe		Date: 28 November 2024	
Location: Workshop		Section: Lathe	
Personal Protective Equipment Used: glasses, face shields, and gloves.			
No.	Description of Work Steps	Potential Hazards	Precautions Analysis Results
A.	**Job Preparation**		
1.	Initial engine inspection	Cable is damaged, start button is problematic	Check the condition of the cables and buttons before use.
2.	Installation of workpieces	Hands are pinched or rubbed by the chuck	Turn off the machine when installing the workpiece, use gloves
3.	Tool holder locking	The chisel came off during the process	Check and lock the tool holder properly before starting.
B.	**Operation Process**		
1.	Machine operation	The workpiece comes loose, pieces of material are thrown off	Make sure the workpiece is clamped firmly, use glasses or a face shield.
2.	During the lathe process	Contact with rotating machine parts, loose clothing	Wear appropriate work clothes, avoid loose clothing
C.	**Completed work**		
1.	Cleaning and maintenance	The machine is still connected to electricity	Make sure the machine is not connected to electricity before cleaning.

Based on Table 5, hazard identification in lathe work includes various potential hazards such as the workpiece coming loose during rotation, hands being caught or rubbed by the chuck, and material debris being thrown during the machining process. Other risks include injuries due to contact with rotating machine parts and electrical short circuits due to faulty cables or start buttons. To anticipate these hazards, precautions are taken such as ensuring the workpiece is firmly clamped, turning off the machine when installing or removing the workpiece, and using personal protective equipment (PPE) such as safety glasses or a face shield. In addition, operators should avoid loose clothing and check the tool holder lock to prevent the tool from coming loose. Finally, the machine must be ensured to be disconnected from the power source before cleaning or maintenance is carried out.

4. DISCUSSION

Gajah Tunggal Polytechnic is a private diploma III (D3) college with scholarships established in 1981. Its goal is to produce superior, work-ready engineering professionals. The Mechanical Engineering vocational program is open to all levels of education, including high school and vocational high school graduates. In the Mechanical Engineering major, students will learn about tools such as lathes, welding, bench grinders, milling, and hand grinders, all designed to equip them with relevant skills in the industrial world. Because students enrolling in this D3 program are also high school graduates, many students lack practical experience. During lectures in the workshop, there are potential hazards that must be anticipated, potentially leading to work accidents. Therefore, the Job Safety Assessment (JSA) is used as a hazard identification tool based on the processes students undergo during practical activities.

Each process is broken down into three key stages: preparation, operation, and completion, allowing for a more comprehensive process identification. A total of 35 hazards were identified, divided into several processes: SMAW welding with eleven hazards, hand grinding with six hazards, grinding with six hazards, milling with six hazards, and lathes with six hazards.

Based on the compiled results, various potential hazards were identified. These activities carry a high level of risk and can endanger students and workers (Hamdani and Andesta, 2024). Therefore, preventative measures are needed to reduce these risks, such as implementing substitution, engineering control, administrative management, and the use of personal protective equipment (Fakhriansyah et all, 2022). Therefore, preventative measures are needed to reduce these risks, such as substitution, engineering control, administration, and personal protective equipment. Hazard mitigation at Gajah Tunggal Polytechnic is carried out using administrative controls and Personal Protective Equipment (PPE) as an effort to prevent workplace accidents during the learning process (Gultom, 2018).

5. CONCLUTION

The results of the identification of five main processes in the workshop, namely the operation of SMAW welding machines, hand grinders, grinding machines, milling machines, and lathes. Each process is divided into three stages: preparation, implementation, and completion of work. Potential hazards identified include sparks, metal fragments, light radiation, damaged cables, non-ergonomic work postures, and the risk of electric shock and physical injury due to improper tool installation. Recommended precautions include the use of personal protective equipment (PPE) such as helmets, goggles, gloves, masks, and aprons, as well as the implementation of safe and ergonomic work procedures. Checking the condition of the tools before use, setting a stable work position, and storing the tools safely after use are important parts of risk mitigation efforts. With details of the results of 35 hazards divided into several processes, namely the SMAW welding process with eleven hazards, the hand grinder process with six hazards, the grinding machine process with six hazards, the milling process with six hazards, and the lathe process with six hazards.

Hazard mitigation at the Gajah Tunggal Polytechnic Workshop is carried out using engineering controls and Personal Protective Equipment (PPE) as an effort to prevent workplace accidents

during the lathe training process. The main activity is carried out by analyzing the potential hazards in each machine and process and adding hazard control through the use of PPE such as gloves, goggles, masks, and safety shoes.

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