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An analysis of 5S culture in project-based learning: a case study in furniture production

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ABSTRACT

Vocational education plays a crucial role in bridging the needs of the workforce through the implementation of industry-based curricula and industrial work culture. One relevant method for establishing a disciplined, efficient, and effective work culture is 5S (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke). This study aims to analyze the implementation of 5S in Project-Based Learning (PBL)-based production activities at the Polytechnic of Furniture and Wood Processing Industry. Data were obtained through direct observation of production activities in the workshop. The results showed that the implementation of 5S was not optimal in several aspects. In the Seiri aspect, unnecessary materials and equipment were found in the work area. In the Seiton aspect, a component grouping and labeling still needed more consistent visual standardization and spatial arrangement. The Seiso aspect was the most critical finding, marked by the presence of oil spills, dust, and sawdust that disrupted cleanliness and potentially posed a safety risk. Meanwhile, the Seiketsu and Shitsuke aspects have demonstrated good implementation through the implementation of SOPs, routine inspections, and disciplined use of PPE. This study recommends improving procedures, regular inspections, visual arrangement, and fostering the habit of cleaning after use. Overall, strengthening the implementation of 5S is expected to improve production efficiency, workplace safety, and student readiness for entering the industrial environment.

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1. Introduction

Vocational education in Indonesia has demonstrated its strategic role in bridging the gap between education and the workplace through relevant industry-based curricula. Aligning the learning process with real-world conditions in the industrial world requires the integration of industrial work culture into the educational environment. Industrial work culture not only fosters disciplined and professional work habits but also instills the values of efficiency, safety, and responsibility for the quality of work results, all crucial aspects of the business and industrial world (DUDI) (Damayanti et al., 2023).

One relevant approach that has proven effective in fostering a disciplined and professional work culture is the 5S method, which stands for Seiri (Sort), Seiton (Set in Order), Seiso (Shine), Seiketsu (Standardize), and Shitsuke (Sustain). This concept originated in Japan and has been widely adapted by various industries in Indonesia as part of strategies to improve work quality and efficiency (Utama & Andesta, 2024) (Guzel & Asiabi, 2020). Implementing 5S has been proven to minimize waste, reduce the potential for workplace accidents, and increase overall productivity and operational effectiveness (Gupta, 2022) (Latifah Ahmad & Nita Kusumawati, 2020). In the context of vocational education, the

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application of the 5S principles is not only relevant as an effort to create an orderly and safe work environment, but also as an industry-based learning tool that students must master to prepare them for entering the workforce (Abu Bakar et al., 2019) .

The learning process employs a Teaching Factory-based approach, where student practicums are designed around real-life projects based on real-world needs and problems in the industrial world. One concrete implementation of this approach is joint production activities with industry partners. This joint production project involves students directly participating in the furniture production workflow, from material sourcing and construction to assembly. Student involvement in this process creates a contextual learning environment that reflects the industrial work environment, making the application of industrial work culture, such as the 5S principles, highly relevant (Kirani et al., 2023) (Bharambe et al., 2020).

During the project, several obstacles were encountered in the field, such as a lack of tidiness and order in the work area, irregular flow of logistical components, and inaccuracy in the production process, which resulted in material waste (Emaputra et al., 2023) (Sundharesalingam* et al., 2020). These problems are suspected to be closely related to the suboptimal implementation of the 5S principles in the production area, resulting in ineffective and inefficient production processes. Therefore, an analysis of the implementation of 5S in furniture workshops during joint production is necessary (Puspitaningsih & Etruly, 2023). This analysis aims to assess the extent to which industrial work culture has been consistently implemented in the workshop environment, particularly in the context of collaboration with industrial partners. The production process can run smoothly when all areas work together to achieve optimal results in line with company goals (Tiara et al., 2020) (Made Iska Aprilia Wardhani & Tasnim Nikmatullah Realita, 2022). An unfavourable work environment increases production productivity, which impacts product quality (Etruly & Nafi'ah, 2023).

The results of this analysis are expected to make a tangible contribution to efforts to develop and improve the quality of future production collaborations, particularly within the vocational higher education ecosystem (Nindiani et al., 2025; Zuhair et al., 2025). Thus, creating an organized, efficient work environment aligned with global industry standards will not only improve the quality of the production process but also strengthen the role of vocational education in preparing competent and work-ready graduates.

2. Methods

This study employed a quantitative research design, combining survey methods with direct observation of the implementation of project-based learning. Data were collected in the field in accordance with Table 2, along with documentation of findings related to the 5S principles. Researchers used the 5S method to describe conditions found in the field. The data used in this study were obtained through field observations of the Project-Based Learning production process at the Polytechnic of Furniture and Wood Processing Industry (Nurcahyo et al., 2019).

The purpose of this study was to analyse the implementation of 5S in Project-Based Learning at the Polytechnic of Furniture and Wood Processing Industry. The data used in this study came from direct observations and interactions with relevant parties. The implementation of 5S also supports government bureaucratic reform efforts, particularly within the Clean Indonesia National Movement.

The following illustrates the research flow used.

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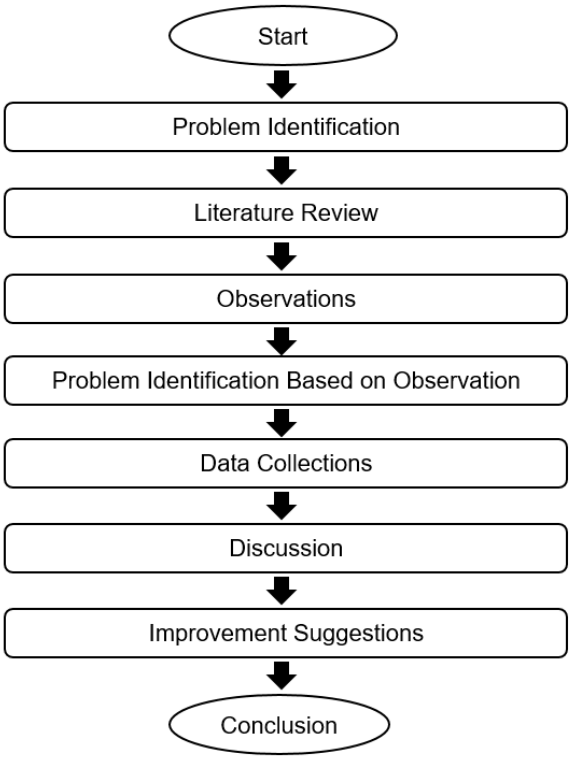


Fig. 1 Research diagram.

The diagram in Fig. 1 can be explained as follows:

1. Problem identification was carried out by the author to identify problems from the daily work activities of operators in the production process in the implementation of Project-Based Learning.
2. Literature review was conducted to identify relevant methods for finding solutions to the problem formulation. The methods and theories used in this study were drawn from various previous research sources.
3. Observations are carried out by directly reviewing field conditions to identify problems that arise during the observation.
4. Observation-Based Problem Identification is conducted based on field observations. This step aims to explore real-world problems discovered during the observations, formulate more focused problems, and identify key aspects that need to be collected and discussed in the research.
5. Data collection was conducted through direct field observations. The data obtained was then processed for discussion and analysis in the next stage. he respondents in this study were the head and the secretary of the teaching factory unit, both of whom are responsible for the implementation of project-based learning. The selection of these respondents was based on their roles, as they are accountable for the entire process of project-based learning, from initial implementation to completion, and are involved in all stages of its execution.
6. Data collection was conducted through direct observation and the results of joint discussions. The collected data are presented in Table 2.
7. Discussion was conducted by processing and analysing the previously collected data. At this stage, the findings were compared with previously obtained literature to determine the alignment and differences between theory and practice in the field.
8. Improvement suggestions are developed based on the analysis results from the previous discussion process. This step aims to provide recommendations or actions that can be implemented to improve less-than-ideal conditions.

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9. Conclusion are drawn based on the results of the analysis. This is the final step, aiming to answer the research problem formulation and summarize the research findings.

3. Results and Discussion

Data Collection and Analysis

The results of the observations aim to analyze the implementation of 5S in the production process of the project-based learning conducted in the furniture workshop at the Polytechnic of Furniture Industry and Wood Processing. This field observation aims to determine the effectiveness of 5S implementation and identify problems that may arise in its implementation, which can ultimately increase work productivity, speed up the workflow, and reduce waste. The observation results can be explained through Table 1.

Table 1 Observation Result

No	Area	Image	Description
1.	Material Warehouse		There are unnecessary components in the material warehouse such as damaged, defective, and undersized and unlabeled components (necessary and unnecessary).
			There is no signboard or Material Warehouse label.
			The material components are stored according to their categories and have been labeled with component information.
	Production Area		There is oil, dirt and equipment that is no longer needed in the production machine area.
			
			There is sawdust or waste on the floor of the production area.

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No	Area	Image	Description
			There are unused damaged materials and unused tools in the work area
			Only components being worked on at that time are brought to the workbench.
			

Based on the observations in Table 1, the implementation of 5S in the Material Warehouse and Production Area still requires improvement by the resources involved in the process, from material storage to production in the workshop area. Cleanliness and tidiness of the workspace are the responsibility of each individual assigned to each task. A 5S work culture must be implemented in the work environment to prevent waste or equipment damage that could lead to worker injury. The goal of implementing 5S is to create a comfortable work environment and increase efficiency in finding tools or materials, which ultimately leads to increased work productivity.

Based on the observations, several aspects were identified that did not align with the application of 5S principles. Some alternatives that can be offered to improve the implementation of 5S in project-based learning workshop environments are establish written procedures for placing materials in the work area, returning used equipment to its proper location, and labelling damaged, defective, or undersized components. Written procedures can include guidelines for implementing the 5S principles and conduct unannounced inspections without prior technical team knowledge. Inspections are conducted based on the inspection table shown in Table 2. The instruments presented in Table 2 are derived from One Asia Consulting Co., Ltd.

Table 2 5S Inspections Checklist Result

5S	No	Questions	Checklist Score			
			1	2	3	4
Seiri (Sort)	1	Is there any unnecessary material or component?				√
	2	Is there any unnecessary device or machine?				√
	3	Is there any unnecessary equipment, tool, or mold?	√			
	4	Is unnecessary item clearly identified?				√
	5	Is there a criterion for "necessary" and "unnecessary" items?	√			
Seiton (Set in Order)	6	Is there location label?	√			
	7	Is there item label?				√
	8	Is there quantity label?				√
	9	Is there signs in the aisle?	√			
	10	Is there measure in place to make items easy to retrieve and return?				√

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5S	No	Questions	Checklist Score			
			1	2	3	4
Seiso (Shine)	11	Is there dirt, water, oil, or other debris on the floor?		√		
	12	Is there dirt on the machinery? Are there oil leaks?		√		
	13	Are cleaning and inspections performed simultaneously?	√			
	14	Is cleaning performed by all employees?		√		
	15	Is cleaning routinely performed?				√
Seiketsu (Standardize)	16	Are the air emissions and ventilation in good condition?				√
	17	Is there sufficient lighting?				√
	18	Are employee uniforms clean?				√
	19	Is there a system in place to maintain cleanliness?				√
	20	Are there rules for maintaining the 5Ss?	√			
Shitsuke (Sustain)	21	Do employees adhere to dress codes?				√
	22	Do employees greet each other appropriately?				√
	23	Are smoking and break time regulations adhered to?				√
	24	Are regulations reviewed daily?				√
	25	Are rules and regulations adhered to?				√
		Score	6	6	0	64
		Total		**76**		

Score criteria:
1 = Very poor (no 5S implementation)
2 = Poor (minimal and inconsistent implementation)
3 = Good (consistent implementation but with some shortcomings)
4 = Excellent (consistent and comprehensive implementation)

Maximum total score is 100, with the following interpretation:
81 - 100 = Excellent
61 - 80 = Good
41 - 60 = Average
21 - 40 = Poor
1 - 20 = Very Poor

Dimension Analysis

Table 2 shows the 5S assessment used in the Furniture Workshop at the Polytechnic of Furniture and Wood Processing Industry. Overall, the 5S assessment results in the furniture workshop area indicate that the 5S aspects have been implemented effectively, with a score of 64.

- Seiri
  In the summary aspect, activities focus on sorting, selecting, and separating items in the work area according to their level of need and frequency of use. Observations revealed the presence of unnecessary materials and equipment in the work area. This indicates that the selection and elimination process for unnecessary materials and tools has not been implemented consistently, hindering operator workflow, increasing the time spent searching for tools, and reducing the effectiveness of production space utilization, thus increasing the risk of workplace accidents.

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- Seiton
  Components stored in the material warehouse area have been structured according to component category. This grouping makes it easier for operators and students to find the necessary components without wasting time searching. In addition to grouping by category, components are also equipped with information labels or component identification that include the number of components and the processing stages completed in the production process. Labelling facilitates control of the number of components that can be continued in the assembly process by the next operator. Components are arranged on warehouse tables or pallets according to the principle of "easy to retrieve and easy to return." Components that will be assembled first are placed in easily accessible locations, while components with less frequent use, or those undergoing final assembly, are placed at the back. This arrangement system aligns with the principles of efficient logistics flow and can reduce the potential for material picking errors.

- Seiso
  The cleanliness aspect emphasizes work area cleanliness through routine cleaning of both machines and work areas, as well as proper handling of production waste. Observations at the Polifurneka workshop indicate that the cleanliness aspect still requires attention and improvement, particularly in areas related to dust, oil, and production process residue. Field observations revealed oil spills, particularly around machines that use lubricants. This condition not only disrupts the aesthetics of the work environment but also increases the risk of workplace accidents such as slips and falls for operators and students. Furthermore, sawdust and dust can still be seen accumulating in several corners of the floor and around cutting machines, sanders, and work tables. This accumulation of sawdust has the potential to impede environmental cleanliness, damage the surface quality of products being processed, and can become a fire hazard if not handled routinely. This also indicates that routine machine cleaning (after-use cleaning) is not being implemented optimally. Machine cleanliness is a key factor in maintaining performance, durability, and operational safety.

- Seiketsu
  In general, the workshop is well-lit, thus conducive to production activities and practical learning. Furthermore, the technical team, or silver experts, have adopted clean clothing habits and wear appropriate uniforms. Observations revealed that SOPs for waste management are in place throughout Polifurneka, but implementation by the technical team and students is not consistent across the workshop, potentially contributing to a decline in cleanliness.

- Shitsuke
  Observations regarding diligence/discipline revealed that the technical team and students consistently adhere to workshop rules regarding the use of PPE, the prohibition of smoking, and adherence to proper dress code. To ensure compliance with applicable regulations, routine inspections are conducted once a month. This inspection serves as a control mechanism to ensure that all regulations have been consistently implemented while providing feedback if any discrepancies occur. In addition to routine inspections, monthly safety awareness is also routinely conducted, namely refresher activities related to HSE and work safety for the entire Polytechnic community. This demonstrates that the entire Polytechnic community, especially workshop users, are committed to maintaining established standards, tidiness, and work safety. Compliance with the use of PPE is an indicator that awareness of work safety has been ingrained in the workshop environment. The implementation of the no-smoking rule in the production area is also carried out as a fire prevention measure and maintain air quality in the work area.

Improvement Suggestions

The following table are improvement suggestions that can be made to improve existing conditions.

Table 3 Improvement Suggestions

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No	Improvement Suggestions	Description
1	Compact Concept	Implementing the compact concept requires the commitment of all parties involved in the work area in the workshop to identify materials and tools in the work area and categorize them into "necessary" and "unnecessary" categories. Unnecessary materials and tools must be immediately moved to the storage area or returned to the warehouse. Materials or tools that are no longer fit for use can be destroyed. Necessary materials and tools are then stored in a dedicated storage area in accordance with the applicable SOPs for that area.
2	Neat Concept	Overall, the implementation of the neat aspect in the material warehouse area has helped improve efficiency, smooth material flow, and component inventory accuracy. However, improvements are needed, including standardizing component labels and codes, including production codes and component sizes, and labelling storage areas. Improvements to the component storage area can be made by placing frequently retrieved components on shelves at a height of 80 - 150 cm for ease of access by operators. Place large components close to the floor to reduce the risk of injury and adjust the distance between storage tables or shelves to ensure safe passage for trolleys. Furthermore, visual marking or the addition of coloured lines to the floor (flooring) for pallet parking areas and goods movement paths should be implemented.
3	Cleanliness Concept	Observations indicate that implementation of the cleanliness aspect still requires standardization of procedures, increased operator discipline, and regular monitoring of work area cleanliness.

4. Conclusion

Based on observations and assessments of each 5S element, it can be concluded that the implementation of 5S in the workshop has shown positive progress but still requires improvement in several aspects. In the Seiri (Sort) aspect, unnecessary materials and equipment were still found in the work area. This indicates that the sorting and elimination process was not running optimally, potentially disrupting workflow and space efficiency. In the Seiton (Set in Order) aspect, the grouping and labelling system for materials and components in the warehouse has been implemented well. The structured arrangement supports easy retrieval and return of goods. However, more consistent visual standardization and zoning are still needed for more effective storage management. In the Seiso (Shine) aspect, oil spills, sawdust on the floor, and dirt on several machines were still found. This indicates that post-use cleaning practices for machines have not been carried out in a disciplined manner. This condition has the potential to threaten the safety and quality of the production process. In the Seiketsu (Standardize) aspect, the work environment is generally clean and bright, and there are basic rules regarding cleanliness and work appearance. In terms of Shitsuke (Sustain), safety regulations such as the use of PPE, smoking bans, and monthly inspections have been implemented effectively. However, increased supervision and on-going training are needed.

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