

# 3. Rearranging Laboratory Design towards

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# Rearranging Laboratory Design towards Good Vocational School Governance

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**Abstract**— Rearranging laboratory design is the main objective of research to provide good vocational school governance through micro improvement in the laboratory. This study reviews and analyzes the design of the laboratory comprehensively with the principle of good governance, i.e., accountable, transparent, effective, efficient and fair. Besides, the integration of 5S culture (seiri, seiton, seiso, seiketsu, and shitsuke), implementation of work safety, and attention in ergonomic checkpoints are formulations developed in this research. The research uses research and development method in three main stages, such as pre-research, development, and evaluation. The development of the laboratory is specifically for industrial automation laboratories. Data collection was based on 30 informants at the national FGD from the best practices vocational school principal in Indonesia as well as the Directorate of Vocational High School Development (DPSMK) of the Ministry of Education and Culture of the Republic of Indonesia. Data collection techniques using questionnaires, observation sheets, in-depth interviews, and document studies. The results of the study obtained a laboratory rearrangement design that showed a high contribution to the effectiveness of good vocational laboratory governance.

**Keywords**— Rearranging Laboratory, Good Vocational School Governance, Laboratory Governance, Good School Governance, Industrial Automation.

## I. Introduction

Students can improve their skills in the vocational field to produce a product that has been prepared by the instructor (Sudira, 2016). Effective vocational laboratories for learning are those that replicate laboratories in the industry (Prosser & Quigley, 1950). Students can improve their skills in the vocational field to produce a product that has been prepared by the instructor (Setiadi et al., 2018). This means that a laboratory is a place where practicum, the tools used to complete the work, the things that might be repaired, and the existence of jobs that can make or produce specific products. In general, the requirements that must be possessed by a laboratory contain three elements, namely: safety, comfort, and energy efficiency (TSI Incorporated, 2014).

To reach a laboratory that has a predicate of good governance needs to be integrated. Governance is a benchmark in the management of a vocational school. The emergence of the "Good" connotation began when the ex-President of the World Bank, Barber Conable (1986-1991), used the term "good governance" to give the title of efficient public services, a reliable system of justice, and good public administration (Tripathi, 2017). Good governance is considered as a new paradigm in the field of public management (Vyas-Doorgapersad & Aktan, 2017). Besides, good governance describes the mechanism that organizations use to ensure that their constituents follow established processes and policies (Kefela, 2011). Thus, the relationship between good governance and laboratory management is how to manage laboratories based on the principles of good governance which include participatory, consensus-oriented, accountable, transparent, ethical, meritocratic, responsive, effective and efficient, quality oriented, fair and inclusive, decentralized and follows the rule of law (Vyas-Doorgapersad & Aktan, 2017).

Achievement of vocational laboratory governance that is good at replicating what is real in the industry. The industry applies the same policies, namely the application of occupational safety and health, the implementation of 5S (seiri, seiton, seiso, seiketsu, and shitsuke), and works in the laboratory about ergonomic checkpoints. Occupational safety and health are things that must be in a school laboratory. Hughes & Hughes, (2017) suggest that health and safety are about preventing people from being harmed at work, by taking the right precautions and by providing a satisfying working environment. Safety work is related to preventing people from being harmed at work, by taking appropriate precautions and by providing a satisfying work environment.

Practical learning in a vocational school laboratory is essential to pay attention to the ergonomic checkpoint. The Ergonomic checkpoint will provide the atmosphere in the laboratory to be safe and comfortable. Instructors need to

convey this to their students to avoid physical hazards. Ergonomics has a function which can make it easy for humans to do a job (Larson, 1998). Besides, laboratory managers need to prepare technical aids that provide comfort, safety, and ease of work. For example, schools need to design ergonomic chair and table designs by paying attention to the typical posture of students, the flexibility of arrangement, functioning, and materials used in tables and chairs.

Utilization of a work environment that includes equipment, documents, buildings and rooms to train students' habits to improve work discipline. The spatial management system carried out in managing the workplace needs to be considered carefully. The laboratory is organized neatly, safely, comfortably, which produces high-quality products, emphasis on costs, timely completion, guaranteed safety, high morale, and guaranteed environment are a reflection of the successful implementation of integrated 5S.

The advantages in applying 5S rules from all sides relating to productivity by calculating zero breakdowns, zero defect, zero waste, zero set up time, zero late delivery, zero injuries, zero customer claim, and zero deficit (K. I. Ismara, Pertiwiingrum, Fitrihana, & Khurniawan, 2018). 5S if run well, of course, laboratory governance will be better, comfortable, attractive, small accidents, no damage, and maximize the performance of the resources inside.

This study aims to develop laboratory designs that are oriented to good vocational school governance by reflecting transparent, accountable, fair, effective and efficient governance principles. By integrating the implementation of 5S, occupational safety and health, as well as paying attention to ergonomic checkpoints in work, it is expected to be able to support vocational school governance on micro problems at the laboratory level.

## II. Methods

This research uses research and development methods adopted by Borg & Gall (1983) in three main stages, such as pre-research, layout development, and model evaluation. Pre-research has carried out through studies and in-depth observations of five vocational schools, i.e. SMK Ma'arif 1 Kudus, SMK Tunas Harapan Pati, SMK St. Mikael Solo, SMK Negeri 4 Jakarta, and SMK Negeri 2 Depok Sleman. The results of the pre-research were developed in the development and rearrangement of laboratory layout designs that were principled on 5S, work safety, and ergonomic checkpoints, all of which were adjusted to good vocational school governance with the principles of transparency, accountability, fairness, effectiveness, and efficiency.

The layout development exemplified in this research is an industrial automation laboratory that is relevant to the ideal needs of 21st-century laboratories. After being developed, layouts were evaluated through a group discussion forum (FGD) with 30 best practices vocational school principals in Indonesia and the Directorate of Vocational High School Development (DPSMK) Ministry of Education and Culture of the Republic of Indonesia.

Data collection techniques used questionnaires, observation sheets, in-depth interviews, and document studies, while data analysis was carried out through descriptive statistics.

## III. Results

This research is directed at rearranging industrial automation laboratories that are principled in good vocational laboratory governance. Industrial automation is one of the competencies of expertise in the technology and engineering fields. Selection of skills competencies because these competencies are relevant to the industrial era 4.0. Industrial automation work has used many robotic technologies, even wireless ones.

This study will provide futuristic views and insights regarding the design of industrial automation workshops along with supporting facilities to support the 4.0 industrial revolution movement.

According to the Minister of Education and Culture Regulation No. 8 of 2018 concerning Physical Allocation Funds (DAK) in the Field of Education, that 2-dimensional plan has been provided for one class of competency skills in industrial automation expertise in Vocational High Schools.

However, the arrangement of tools and machines with a standard size is that each one of the students given a work area of 3 m<sup>2</sup> is not ergonomic if all the tools in the permenedikbud are poured into the practice room.

Besides, industrial automation laboratories are increasing in number. A laboratory that is comfortable and safe when using ergonomic checkpoints, available K3 equipment, and complete disaster mitigation. Available i-spaces and free discussion area in the laboratory to improve the creativity and innovation of Vocational students when using the practice room. Next is the ideal design of industrial automation engineering laboratories in Vocational Schools.



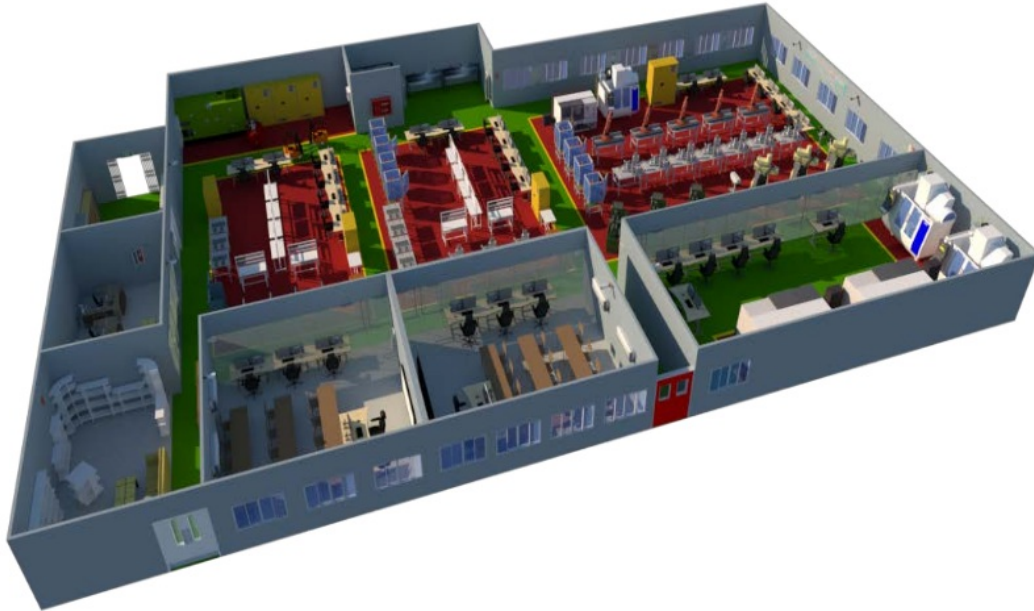


Figure 1: Isometry of Industrial Automation Laboratory According to the Good Vocational School Governance Principles

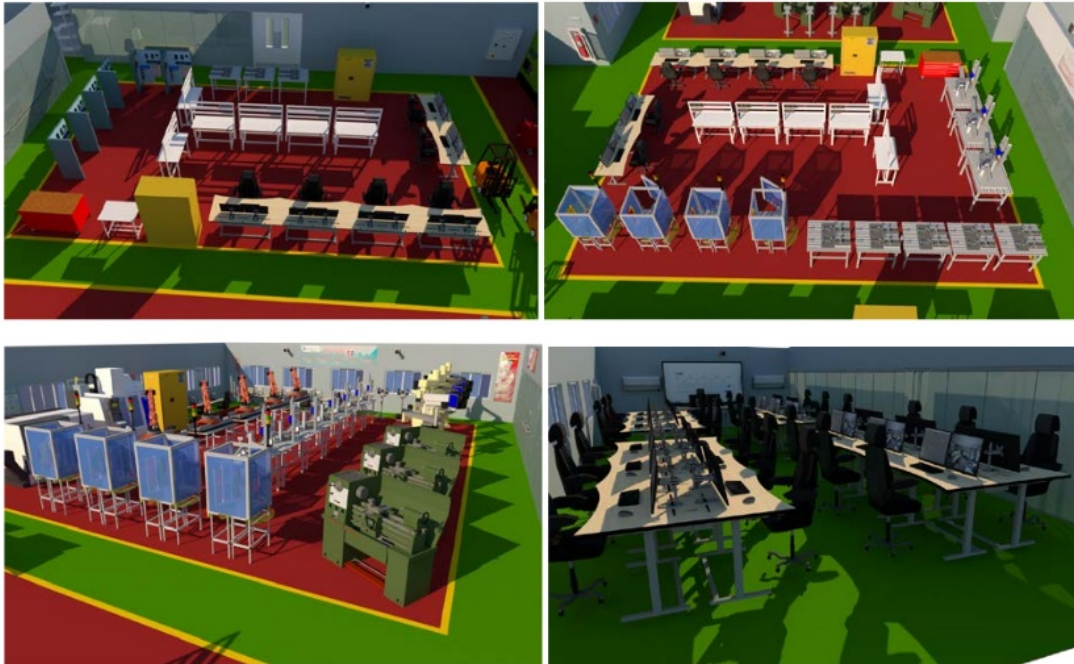


Figure 2: Illustration of each Sub-laboratory

Figures 1 and 2 show the re-compliance of industrial automation laboratories. This arrangement is of course equipped with devices in it that provide accountability, transparency, effectiveness, and efficiency in the management of good vocational laboratories. Based on the results of the FGD and the response of the workshop manager, the analysis conclusions were obtained as follows.

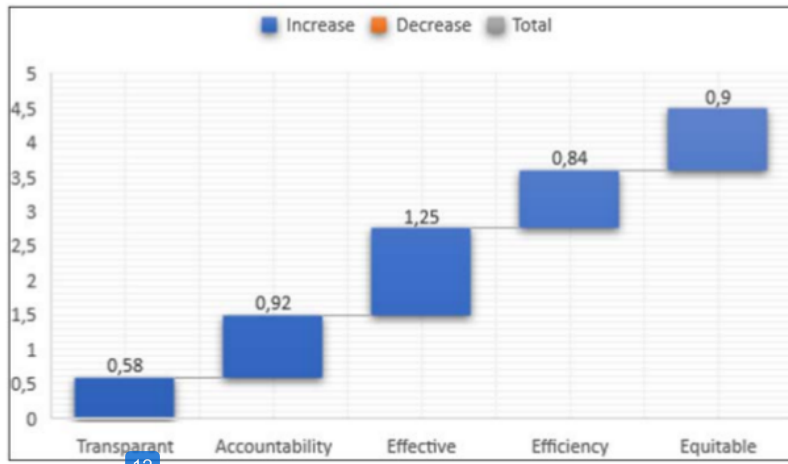


Figure 3: The Impact of the Principles of Good Vocational School Governance in Laboratory Settings

The graph above shows that the highest value is effectiveness. The existence of 5S culture, occupational safety and health, and working with attention to ergonomic checkpoints shows good governance in vocational laboratories. The supporting devices to complete the facilities in good vocational laboratory governance are as follows.

Table 1: Ideal Area of Industrial Automation Laboratory

	Work Area	Qty	± Area of Work Space (m <sup>2</sup> )	Total Area (m <sup>2</sup> )
1.	Storage warehouse and Toolman Room	1	72	72
2.	Instructor Room	1	24	24
3.	Living Room and Display	1	18	18
4.	Theory Room (VR & AR)	2	72	144
5.	Discussion Room (I-Spaces)	2	48	96
6.	Basic Laboratory of Electrical, Hydraulic and Pneumatic Engineering	1	117	117
7.	Electronic Control Laboratory	1	93	93
8.	Automation Industry Laboratory	1	119	119
9.	Mechatronics Laboratory	1	96,5	96,5
10.	Toilet and dressing room	2	9	18
11.	Compressor and Electrical Insulation Room	1	6	6
12.	Material Handling track area	6	2,5	15

#### IV. Discussions

Based on the results of the layout development, there are some excellent inputs in developing laboratory layouts. The element of good governance reflected in the layout is displayed in the production process that is effective and efficient in practicum. The flexible and dynamic arrangement makes the laboratory can be used optimally. This concept is relevant to the concept of occupational health today increasingly changing, not just "health in the industrial sector" but also leads to health efforts for all people in doing their work (total health of all work) (Katsuro, Gadzirayi, Taruwona, & Mupararano, 2010). Good governance guarantees the integrity, safety, and perfection of both the physical and spiritual learners of their work/products. The general standards of safety and health of school workshops needed as mentioned by (Brown, 1976; Prakken, 1973) consist of: (a) Control of safety and health for workshop users; (b) Separating hazardous materials; (c) Personal protective equipment; (d) Environmental control; (e) First aid and medical services; (f) Fire suppression devices; (g) Handling and protection of materials; (h) Operation machines and machine protectors; (i) Welding, cutting and desoldering; and (j) Special industries.

Learning about ergonomics in good governance, we can reduce the risk of disease, minimize health costs, be comfortable while working and increase productivity and performance and gain many benefits. Ismara, Khurniawan, Dwijonagoro, Harsana, & Pertiwiningrum (2017) mentioned that the application of the principle of ergonomics in the workplace could produce the following benefits.

1. Understand the influence of a type of work on the employee and his performance
2. Predict the potential influence of work on the body of workers
3. Evaluate the suitability of the workplace and equipment at work
4. Increasing productivity and efforts to create conformity between worker capabilities and work requirements.
5. Build basic knowledge to encourage workers to increase productivity.
6. Preventing and reducing the risk of occupational diseases
7. Increasing work safety factors
8. Increase profits, income, health, and welfare for individuals and institutions.

Successful performance in vocational laboratories is assessed by environmental conditions in the workplace. Laboratories with poor governance can be seen from changing work situations, the number of rejects or rework, poor student attendance values, and so on. 5S is not difficult to understand, but 5S is complicated to implement correctly. 5S requires persistence, determination, and requires continuous effort. 5S may not produce dramatic results. However, 5S makes work more accessible. 5S will reduce the waste of our work time. 5S will make us proud of our work. 5S will improve work productivity and better quality, little by little, but continuously. That means 5S's role in regulating vocational laboratory governance has an impact on effectiveness and efficiency in practicum.

## V. Conclusion

Layout which was developed based on the pre-research, development and evaluation stages of the model concluded that there needs to be a revision of the current layout of vocational school laboratories to achieve good governance with principles of accountability, transparency, efficiency, effectiveness, and fairness. The results of the FGD show that effectiveness provides the highest assessment that has an impact on laboratory rearrangement by integrating the principles of work safety, 5S culture, and work based on ergonomic checkpoints.

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