

IMPLEMENTATION OF SAFETY STANDARDS IN VOCATIONAL SCHOOL COMPUTER LABS : A CASE STUDY OF PRIVATE VOCATION SCHOOL IN PEKANBARU

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Abstract

Safety in educational environments, particularly in vocational school laboratories, is an essential aspect because every activity contains potential hazards and occupational risks. This study aimed to analyze the implementation of laboratory safety standards in the Computer and Network Engineering laboratory at SMKS PGRI Pekanbaru, Indonesia. This study used a descriptive qualitative design through in-depth interviews, direct observation, and documentation review conducted from June to August 2025. Six informants participated in this study, consisting of one key informant, two laboratory supervisors, one teacher, and two students. The variables examined included human resources, laboratory facilities and infrastructure, standard operating procedures (SOPs), personal protective equipment (PPE), and occupational safety and health implementation. Data were analyzed using triangulation techniques. The findings revealed that laboratory safety implementation had not fully met occupational safety requirements. Several contributing factors were identified, including limited occupational safety training among laboratory personnel, incomplete safety facilities, absence of written SOPs, inconsistent PPE compliance among students, weak supervision, and inadequate evaluation documentation. The results were summarized using an Ishikawa (fishbone) diagram to identify the root causes affecting laboratory safety implementation. The study concludes that strengthening safety training, improving laboratory safety facilities, developing written SOPs, and conducting routine supervision are necessary to optimize laboratory safety standards and minimize occupational risks in vocational school laboratories.

Keyword : Laboratory Safety; Occupational Safety and Health; Vocational School; Computer Laboratory; Safety Standards

INTRODUCTION

Occupational safety and health (OSH) is an important component in educational institutions, particularly in vocational schools that conduct laboratory-based practical learning activities. Every activity carried out in laboratories contains potential hazards and risks that may lead to occupational accidents, injuries, or environmental damage if not properly controlled. Therefore, the implementation of safety standards in educational laboratories is essential to protect students, teachers, laboratory staff, and surrounding environments [1].

According to the International Labour Organization (ILO), occupational accidents and work-related diseases remain major contributors to mortality and disability worldwide. The implementation of occupational safety and health systems is necessary to reduce the occurrence of workplace accidents and improve safety awareness in educational and industrial environments [2]. Vocational schools are institutions that emphasize practical competencies;

therefore, students are frequently exposed to various occupational hazards during laboratory activities.

Based on the Regulation of the Minister of National Education of the Republic of Indonesia Number 40 of 2008 concerning Standards for Facilities and Infrastructure for Vocational High Schools, vocational schools are required to provide adequate educational facilities, including laboratories, to support learning activities [3]. Laboratories play a significant role in supporting students' competencies through practical learning activities [4]. Computer laboratories in vocational schools involve hazards related to electricity, electronic equipment, cables, improper work procedures, and inadequate emergency preparedness. Laboratory management related to occupational safety and health should include competent human resources, adequate facilities, safety equipment, standard operating procedures (SOPs), and proper supervision systems [5]. Students are also required to use personal protective equipment (PPE) before conducting practical activities in laboratories [6].

The implementation of occupational safety and health in vocational schools can be assessed through several aspects, including safety attitudes, PPE usage, work environment conditions, adherence to SOPs, and implementation of occupational safety culture [7]. Failure to implement these aspects properly may increase the risk of occupational accidents and unsafe learning environments.

SMKS PGRI Pekanbaru is one of the vocational schools in Pekanbaru that has an active Computer and Network Engineering (TKJ) department with intensive laboratory practice activities. The school has four active study programs with a total of 433 students, including 143 students in the TKJ department. However, the implementation of laboratory safety standards in the computer laboratory has never been formally evaluated. Preliminary observations indicated several safety-related issues, including incomplete safety facilities, lack of written SOPs, and inconsistent use of personal protective equipment (PPE). These conditions may increase the risk of occupational accidents and create unsafe learning environments. Therefore, this study aimed to analyze the implementation of laboratory safety standards in the Computer and Network Engineering laboratory at SMKS PGRI Pekanbaru

RESEARCH METHODS

This study used a qualitative descriptive research design. Data collection was conducted through in-depth interviews, direct observation, and documentation review. The study was carried out at SMKS PGRI Pekanbaru from June to August 2025.

The study involved six informants selected purposively based on their involvement in laboratory activities and management. The informants consisted of one key informant, two laboratory supervisors, one teacher, and two students.

The variables examined in this study included human resources, laboratory facilities and infrastructure, standard operating procedures (SOPs), personal protective equipment (PPE), and occupational safety and health implementation. Data validity was ensured through triangulation methods by comparing interview findings, observation results, and documentation data. Data analysis was conducted through data reduction, data presentation, and conclusion drawing.

RESEARCH RESULTS

The findings of this study are presented using an Ishikawa (fishbone) diagram to identify the main factors contributing to the suboptimal implementation of laboratory safety standards at SMKS PGRI Pekanbaru.

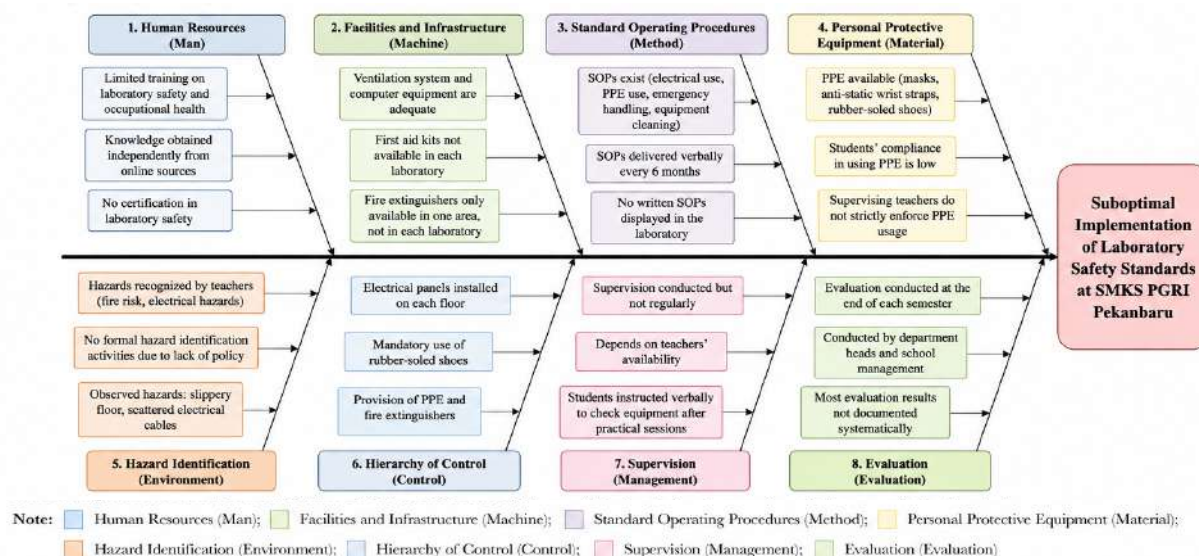


Figure 1. Ishikawa (Fishbone) Diagram of Factors Affecting the Implementation of Laboratory Safety Standards at SMKS PGRI Pekanbaru.

The diagram shows that several factors contributed to the inadequate implementation of laboratory safety standards, including limited occupational safety training among laboratory personnel, incomplete safety facilities, absence of written standard operating procedures (SOPs), inconsistent use of personal protective equipment (PPE), weak supervision, and inadequate evaluation documentation.

DISCUSSION

Human Resources

The findings showed that human resources involved in laboratory management at SMKS PGRI Pekanbaru consisted of school management, department heads, laboratory technicians, and teachers. However, most laboratory personnel had never received formal occupational safety and health training related to computer laboratory safety. Most safety knowledge was obtained independently through online media and personal experience.

According to the Regulation of the Ministry of Education and Culture Number 34 of 2018 concerning Vocational School Infrastructure Standards, laboratory managers should possess competencies related to technical and safety aspects [13]. Lack of safety training may increase the risk of procedural errors, laboratory accidents, and equipment damage.

This finding is consistent with Cahyaningrum's study, which stated that occupational safety and health programs in educational laboratories require strong management commitment and participation from all laboratory users and managers [14].

Therefore, improving occupational safety and health training programs for laboratory personnel is essential to increase safety awareness, improve competencies, and minimize occupational risks in laboratory environments.

Facilities and Infrastructure

The findings revealed that laboratory facilities such as ventilation systems and computer equipment were generally adequate to support practical learning activities. However, several important safety facilities were incomplete, including the absence of first aid kits in each laboratory room and limited placement of fire extinguishers.

According to the Regulation of the Ministry of Education, Culture, Research, and Technology Number O48/H/KU/2023, vocational school laboratories are required to provide fire extinguishers, first aid kits, safety equipment, and appropriate occupational safety facilities. The absence of adequate safety facilities may hinder emergency responses during occupational accidents or fires. This finding is consistent with previous studies indicating that proper laboratory infrastructure is necessary to support safe educational activities and minimize occupational hazards [9].

Aseng and Hau also emphasized that first aid equipment is an important supporting factor in ensuring safe practical activities in laboratories [15]. Therefore, laboratory safety facilities should be completed and properly maintained to improve occupational safety implementation. Standard Operating Procedures (SOPs)

The findings showed that standard operating procedures related to laboratory safety were still delivered verbally and had not been formally documented or displayed in laboratory areas. Existing SOPs mainly addressed general classroom rules rather than detailed laboratory safety procedures.

SOPs are important administrative controls that guide laboratory users in conducting activities safely and consistently [16]. Effective SOP implementation can reduce occupational risks and prevent laboratory accidents caused by procedural violations.

This study indicates that written laboratory safety SOPs are still inadequate. Therefore, developing and displaying written SOPs regarding electrical safety, emergency response, PPE usage, and equipment handling is necessary to improve safety compliance among students and laboratory personnel.

Personal Protective Equipment (PPE)

The study found that the school provided several PPE items, including masks and anti-static wrist straps. Students were also required to wear closed rubber-soled shoes during laboratory activities. However, observations indicated inconsistent PPE compliance among students.

This finding is consistent with previous research showing that PPE use is an important indicator of occupational safety implementation [7]. Lack of PPE compliance indicates weak safety awareness and insufficient supervision.

Appropriate PPE usage is important to reduce exposure to occupational hazards in computer laboratories, especially hazards related to electricity and electronic equipment. Therefore, stronger supervision and safety awareness programs are necessary to improve PPE compliance.

Occupational Safety and Health Implementation

The findings revealed that hazard identification, supervision, and evaluation activities had been implemented but were still inconsistent and poorly documented. Several potential hazards identified during observations included slippery floors, scattered electrical cables, and improper equipment arrangement.

According to the Occupational Safety and Health Administration (OSHA), effective occupational safety implementation includes hazard identification, hierarchy of controls, supervision, and periodic evaluation [18]. Hazard identification is an important step in preventing occupational accidents and improving workplace safety.

The school had implemented several control measures, including electrical panels, fire extinguishers, and mandatory use of rubber-soled shoes. However, supervision activities were conducted irregularly and depended on teachers' availability.

This finding is consistent with Handayani's study, which emphasized that successful occupational safety programs in educational institutions depend on management commitment and participation from teachers, staff, and students [19].

Solichin also stated that improving occupational safety awareness, hazard control, and safety facilities is necessary to minimize risks in educational laboratories [20]. Therefore, strengthening supervision systems, conducting routine evaluations, and improving documentation are important steps to optimize laboratory safety implementation.

CONCLUSION

The implementation of laboratory safety standards in the Computer and Network Engineering laboratory at SMKS PGRI Pekanbaru has not fully met occupational safety and health requirements. Several contributing factors affecting laboratory safety implementation include limited occupational safety training among laboratory personnel, incomplete safety facilities, absence of written SOPs, inconsistent PPE compliance, weak supervision, and inadequate evaluation documentation.

Strengthening occupational safety training programs, completing laboratory safety facilities, implementing written SOPs, and conducting routine supervision are necessary to create a safer learning environment and minimize occupational risks in vocational school laboratories.

REFERENCES

1. Sabariah, Srihastuti E. Implementation of safety education in elementary schools. *Jurnal Pendidikan Dasar Islam*. 2023;1(1):15–20.
2. Sutisna NO, Sembiring EC, Ramli S. Analysis of occupational safety management implementation among nurses during the COVID-19 pandemic. *Journal of Applied Management Research*. 2022;2(1):1–10.
3. Hidayati N, Safitri IF. Implementation of infrastructure standards based on Ministerial Regulation No. 40 of 2008 in vocational schools. *Jurnal Manajemen Pendidikan Islam Darussalam*. 2022;3(2):208–226.
4. Prastiyo CA, Tejamaya M. Occupational safety and health culture in vocational high schools in Bekasi City. *Jurnal Kesehatan Tambusai*. 2023;4(2):2561–2572.
5. Mulyah P, Aminatun D. Guidelines for computer laboratory practical implementation and occupational safety. 2020.
6. Christyo R. Modernization of fiber optic laboratories to improve student competencies in computer networking engineering. 2022.
7. Saputra YK, Guntur Y, et al. Analysis of occupational safety and health implementation in automotive vocational competency programs. 2022;5:71–80.
8. Kisno K, Siregar VMM, Sugara H, et al. Occupational safety and health education in vocational schools. *Jurnal Abdi Insani*. 2022;9(2):570–579.
9. Indarwati D. Hazard identification and risk assessment in laboratory occupational safety implementation. *Jurnal Pengelolaan Laboratorium Pendidikan*. 2020;2(2):51–57.
10. Cindy AH, Sugiyono S, Usman H, Herwin H. Factors affecting optimization of vocational school facilities and infrastructure. *Cypriot Journal of Educational Sciences*. 2022;17(2):586–600.
11. Hasibuan EH, Butar-butur K, Meilasari RDD. Overview of occupational safety implementation in vocational laboratories. *Jurnal Kesehatan Ilmiah Indonesia*. 2024;9(1):11–16.

12. Sam'ani S, Qamaruzzaman MH, Sutami S. Implementation of supervision and control systems in vocational computer laboratories. 2020;3(2):303–307.
13. Ministry of Education and Culture. Regulation No. 34 of 2018 concerning vocational school infrastructure standards. 2018.
14. Cahyaningrum D. Occupational safety and health programs in educational laboratories. *Jurnal Pengelolaan Laboratorium Pendidikan*. 2020;2(1):35–40.
15. Aseng MD, Hau RRH. First aid equipment in laboratories as support for safe practical activities. *Intelligentes: Jurnal Pendidikan Fisika dan Sains*. 2021.
16. Yulianta E. Computer laboratory management in Islamic vocational schools. *Indonesian Journal of Multidisciplinary on Social and Technology*. 2024;2(2):39–43.
17. Saputra YK. Occupational safety behavior and implementation among vocational students. 2022.
18. Occupational Safety and Health Administration (OSHA). Occupational safety management guidelines. OSHA Publications. 2021.
19. Handayani R. Occupational safety implementation in educational institutions. *Journal of Educational Safety*. 2023;4(1):55–63.
20. Solichin S. Occupational safety, security, and environmental implementation in educational laboratories. *Journal of Laboratory Safety Management*. 2024;5(2):100–112.