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# *IDENTIFYING THE CAUSES OF ELECTRICAL PRACTICE ACCIDENTS IN VOCATIONAL HIGH SCHOOLS*

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***Abstract***

*The intensity of practical training in Vocational High Schools (VHS) and the use of equipment and machinery set to resemble working conditions in industry are significant risk factors for accidents which occur in electrical and/or electronics laboratories/workshops. This study aims to identify the accidents affecting VHS students and to describe the causal factors of these accidents. This research is descriptive study. Data collection was conducted from August to October 2025, using questionnaires and observation sheets. The study involved 178 respondents in eleventh and twelfth-grade from the Electrical Engineering and/or Electronics Engineering programs in Serang Regency, Indonesia, selected through simple random sampling techniques as determined by WHO sample size determination application. The results indicate that 44.9% of students have experienced accidents during practical training in laboratories/workshops. The most common type of accident reported by students was electric shock (65%), followed by injuries from machinery/equipment (18.6%), slips due to slippery floors, and collisions with panels, tables, and practice chairs (6.3%). Unsafe actions that contribute to accidents include the failure to utilize Personal Protective Equipment (PPE) during practical training, while environmental factors leading to accidents among students include the absence of safety guidelines in schools, laboratories, and workshops. This study found that incidents of electric shock among students are perceived as common and not hazardous. Inadequate understanding and the normalization of accidents among students represent risk factors, alongside the insufficient availability of Occupational Health and Safety (OHS) infrastructure, which further exacerbates the risk of accidents during practical training.*

*Keywords: accident, electric shock, personal protective equipment, Vocational High Schools*

## Introduction

Vocational High Schools (VHS) are institutions designed to produce graduates who are job-ready. In their educational approach, VHS place a greater emphasis on students' skill development, resulting in a higher intensity of practical training compared to general secondary schools. The laboratories and workshops in VHS utilize equipment and machinery configured to simulate working conditions in industry. This setup aims to provide students with an understanding of workplace practices and environments. The conditions within the laboratories,

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as well as the machinery, equipment, and intensity of practical training in VHS, represent significant factors that can lead to occupational safety issues [1,2] if not accompanied by the comprehensive implementation of a safety culture.

The lack of an incident recording system for accidents in schools, particularly in vocational schools, results in Occupational Health and Safety (OHS) not being prioritized within the educational environment[3]. The insufficient awareness regarding the reporting of accidents affecting students[4] impacts the documentation of accident data and the behaviors that contribute to accidents, leading to a significant lack of information. Incidents of injury occurring among VHS students during practical training in laboratories are often regarded as minor injuries that can be overlooked and considered commonplace. This perception allows latent hazards to develop, ultimately resulting in serious accidents.

The curriculum of VHS, which integrates knowledge and skills that support graduate competencies, including the science of OHS, is not sufficiently applicable and systematic in shaping students' safety behaviors. Furthermore, the issues related to workplace safety within VHS are also rooted in the students' lack of experience and maturity in applying safety procedures, as well as their low awareness of safe behaviors while at school[5]. This situation has led to the occurrence of accidents among students during the learning process at school. Referring to previous research findings, it is noted that 59.8% of students reported having experienced accidents during practical training in the school's electrical workshop. This data is further corroborated by a presurvey conducted on April 10, 2025, which revealed that 71% of students in one Vocational High School in Serang Regency had experienced accidents at school.

In Banten Province, several fatal accident cases involving students at schools were recorded during the year 2021[6]. Not only were there fatal incidents affecting students, but there were also reports of school fires in the same year. At the beginning of 2022, five dormitory rooms were reported to have caught fire, allegedly due to electrical short circuits [7]. A study conducted in 2022 at a boarding school indicated that 93% of students reported having experienced accidents while at school [8]. This data underscores that incidents of accidents in schools cannot be overlooked. Research conducted in Turkey reported that 147 students from 20 Vocational Schools experienced accidents during the learning process at school. These accidents ranged from injuries caused by machinery during practical training, electric shocks, cuts, burns, falling objects, to incidents of poisoning within the school environment [9].

Occupational safety is no longer merely an industrial requirement; it has become a necessity across nearly all sectors of employment, including construction, mining, healthcare,

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and, notably, within the educational environment [10–13]. This assertion is supported by the fact that each year, the Social Security Agency (BPJS) records a rising trend in workplace accidents [14]. An analysis of the causes of these accidents indicates that the primary factor contributing to their occurrence stems from unsafe behaviors [15–17].

Each year, more than 2.3 million fatal incidents are recorded as a result of 300 million workplace accidents, particularly affecting young workers aged 15 to 24 years. This phenomenon is attributed to a lack of experience, insufficient skills, and a tendency to underestimate risks in the workplace [1]. Over the past three years, the incidence of workplace accidents in Indonesia has significantly increased. In 2021, a total of 234,371 accident cases were reported. This figure rose by 27% in 2022, reaching 298,137 cases. In 2023, there was a further increase of 30%, resulting in 370,747 reported accident cases. This significant rise in accident cases has also been accompanied by an increase in employment insurance claims [18]. According to the reported accident data, Banten Province is one of the regions with the highest number of accidents in Indonesia, totaling 13,909 cases in industry[19]. The primary cause of these accidents is attributed to unsafe behaviors in the workplace. The increase in the number of accidents in the industry cannot be ignored, considering that young workers are the group that experiences the most accidents.

Data on accidents in schools, including their causal factors, remains challenging to obtain. However, schools are also workplaces that are not exempt from the risk of accidents. As a workplace for teachers and educational staff, as well as a learning environment for students, schools should ideally be safe, ensuring the safety and health of all individuals within the institution. Schools are often categorized as public places with low potential for hazards and risks, leading to the neglect of safety considerations. Nevertheless, schools also possess the potential for accidents that can threaten the safety and health of all occupants [20]. The presence of facilities such as laboratories/workshops and supporting educational infrastructure means that the potential risk of accidents in schools cannot be overlooked. A study in Turkey reported that 78% of students experienced an incident within a month [9], while a study in Finland identified a broad spectrum of incidents ranging from physical to pedagogical aspects[21]. Further, the data shows that the majority of incident reports (95%) involve accidents and *near-misses* on staff triggered by student behavior dynamics [22]. This phenomenon confirms that schools, particularly those with technical infrastructure such as laboratories and workshops, have a risk profile that cannot be ignored.

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Based on this description, significant discrepancy was found in the current OHS study. The majority of previous studies focused on the implementation of OHS policies in general or the psychosocial impact in public schools. The study found in-depth data limitations regarding the identification of specific accidents, analysis of causative factors, and the effectiveness of preventive measures in VHS. The research focuses more exclusively on the Electrical Engineering and Electronics Engineering expertise programs, which are fields that have unique and extreme technical hazard characteristics. By taking the locus in Serang Regency as an industrial area, this study not only maps the prevalence of accidents, but also presents a causality analysis that is integrated with preventive efforts that have been carried out by schools. The main contribution of this study is to fill the empirical data gap regarding the profile of work accidents in technical vocational programs, which is expected to be the basis for the formulation of more specific and applicable safety protocols for stakeholders in vocational schools.

## Methodology

### *Research Design and Participants*

This quantitative study employed a descriptive analytical approach with univariate testing. Univariate testing was conducted to obtain an in-depth overview of the accidents experienced by students in the Electrical Engineering and/or Electronics Engineering programs at VHS, the causal factors of these accidents, the actions taken by students following an accident, and the measures implemented by the schools to prevent such occurrences. The descriptive approach also offers insights into the conditions of the OHS facilities at the schools as reported by the respondents. The results of the univariate tests are presented in the form of tables and pie charts.

The respondents of this study are students in the eleventh and twelfth grades of the Electrical Engineering and/or Electronics Engineering programs, with a total population of 913 individuals. A sample of 178 students was selected using the simple random sampling formula as determined by Lemeshow in the WHO sample size determination application[23]. Subsequently, to determine the sample size for each school, calculations were made based on the proportionate distribution corresponding to the number of students at the schools being studied. Samples from each school were taken proportionately. The inclusion criteria for the sample are as follows: 1) students must be from the Electronics Engineering and/or Electrical Engineering programs; 2) students must be active and present at school during the research

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period; 3) students must be willing to participate as respondents; 4) students must come from schools accredited with grades A, B, or C, whether public or private.

***Data Collection Instruments***

This research was conducted in all Vocational High Schools, both public (government-owned) and private (foundation-owned), that offer programs in Electrical Engineering and/or Electronics Engineering located in Serang Regency, Banten Province. A total of 9 schools were included as subjects of the study. The quantitative data collection for this research took place from August to the end of October 2025.

***Data Analysis***

Data for this research were collected directly using observation sheets and questionnaires. The research questionnaire included questions designed to identify the incidents of accidents experienced by respondents, including the time, location, type of accident, and the actions taken by respondents at the time of the accident. Questionnaire is taken from previous publish research[9] and Heinrich's Domino Theory[24]. Additionally, the questionnaire sought to gather information regarding the causes of accidents, encompassing both environmental factors and unsafe behaviors.

The observation sheet utilized for data collection contains statements regarding the safety facilities present in the school's laboratories/workshops. The safety facilities observed include the Standard Operating Procedures (SOP) or safety procedures displayed in the laboratory, the installation of safety equipment to prevent accidents among students caused by electrical short circuits or other incidents, the availability of safety posters, the presence of first aid kits and their contents, the installation of covers or guards on electrical panels used during student practicals, as well as the availability of Personal Protective Equipment (PPE) for students during practical training. The observed safety facilities also encompass the availability of storage areas for practical equipment and the presence of sinks with running water and soap. The components of the safety facilities were assessed using a Guttman scale with response options of "available" and "not available" [25].

This research has been approved and received an Ethical Review Clearance from the Health Research Ethics Committee of the Faculty of Public Health, Diponegoro University, Semarang, Indonesia. Letter number: 271/EA/KEPK-FKM/2025.

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## Results

### *Characteristics of Respondents*

The respondents in this study are students from Vocational High Schools who meet the inclusion criteria. Out of a total of 913 students in the eleventh and twelfth grades who satisfy the inclusion criteria, 178 individuals were selected as respondents for the research. The characteristics of the respondents are presented in Table 1.

**Table 1.** Characteristics of Students (N=178)

| No. | Variable | Number (n) | Percentage (%) |
|---|---|---|---|
| 1 | Age | | |
| | - 16 | 5 | 2.8 |
| | - 17 | 92 | 51.7 |
| | - 18 | 80 | 45.5 |
| 2 | Sex | | |
| | - Male | 167 | 93.8 |
| | - Female | 11 | 6.2 |
| 3 | Program | | |
| | - Electrical Engineering | 138 | 77.5 |
| | - Electronics Engineering | 40 | 22.5 |
| 4 | Grade | | |
| | - Grade XI | 97 | 54.5 |
| | - Grade XII | 81 | 45.5 |

Based on Table 1, it is evident that the respondents are predominantly male, with an average age of 17 years. This aligns with the field of study being investigated, namely the Electrical Engineering and Electronics Engineering programs, which are more commonly favored by male students. The respondents are primarily from the Electrical Engineering department, and the distribution between grades XI and XII is nearly balanced.

### *Identification of Accidents in Schools*

The identification of accident incidents aims to identify the accidents that students have experienced. This identification also seeks to gather information related to the causes of accidents, encompassing both environmental factors (unsafe conditions) and unsafe behaviors (unsafe actions) exhibited by students. The results of the accident identification provide insights into the actions taken by students following an accident, as well as the efforts made by the school to prevent future accidents, particularly in laboratories and workshops.

Table 2 below presents the research findings that illustrate the incidents of accidents experienced by Vocational High School (VHS) students, including the location of the incidents, the time, the type of accident, and the actions taken by students when the accidents occurred.

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**Table 2.** Accidents among Vocational High School Students

| No. | Question Variable | Number | Percentage (%) |
|---|---|---|---|
| 1. | Having Experienced an Accident | | |
| | - Never | 98 | 55.1 |
| | - Have experienced | 80 | 44.9 |
| 2. | Location of Accident | | |
| | - In the Laboratory/Workshop | 70 | 87.5 |
| | - In the School Environment | 10 | 12.5 |
| 3. | Time of Accident | | |
| | - Recess/break time | 27 | 33.7 |
| | - During Practical Activities in the Laboratory/Workshop | 42 | 52.5 |
| | - During learning in classroom | 7 | 8.7 |
| | - After school | 4 | 5.1 |
| 4. | Type of Accident | | |
| | - Accidents Due to Machinery in the Laboratory/Workshop | 15 | 18.6 |
| | - Injured by Equipment | 2 | 2.5 |
| | - Electrocuted | 52 | 65.0 |
| | - Falling Objects | 1 | 1.3 |
| | - Slipping Due to a Slippery Floor | 5 | 6.3 |
| | - Hitting Panels. Practice Tables. Practice Chairs | 5 | 6.3 |
| 5. | Time of Accident | | |
| | - Morning (between 08:00 and 10:00) | 37 | 46.3 |
| | - Between 10 and 15:00 | 37 | 46.3 |
| | - Between 15:00 and 17:00 | 6 | 7.4 |
| 6. | Actions Taken During an Accident | | |
| | - Reporting to Teacher/School | 24 | 30.0 |
| | - Continuing the Activities | 44 | 55.0 |
| | - Telling to friends | 12 | 15.0 |

Based on the research findings presented in Table 2, it is evident that the number of VHS students who have experienced accidents is nearly equal to those who have not. The majority of accidents occur in laboratories/workshops during practical training sessions. Most students who have experienced accidents reported that they suffered electric shocks, both intentionally and unintentionally, between 10:00 AM and just before school dismissal at 3:00 PM. According to the respondents, experiencing electric shocks is perceived as a common occurrence that does not necessitate reporting to the supervising teacher; consequently, after the accident, students continue their activities.

**Table 3.** Unsafe Actions as Causes of Accident Incidents (N=80)

| No. | Question Variable | Number | Percentage (%) |
|---|---|---|---|
| 1 | Not Wearing Personal Protective Equipment (PPE) During Practical Activities in the Laboratory/Workshop | 37 | 46.25 |
| 2 | Not Adhering to Practical Procedures in the Laboratory/Workshop | 8 | 10 |
| 3 | Not Listening to the Instructor's Explanation During Practical Activities in the Laboratory/Workshop | 2 | 2.5 |
| 4 | Joking with Peers | 10 | 12.5 |

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| No. | Question Variable | Number | Percentage (%) |
|---|---|---|---|
| 5 | Lack of Skill in Using Practical Equipment | 7 | 8.75 |
| 6 | Body Position During Practical Activities is Not Ergonomic/Comfortable | 2 | 2.5 |
| 7 | Using Damaged/Improperly Functioning Equipment | 2 | 2.5 |
| 8 | Not Paying Attention to Surrounding Conditions (Floor. Stairs. School Environment) | 10 | 12.5 |
| 9 | Other | 2 | 2.5 |

Table 3 presents the causal factors of accidents that occurred among students during learning activities at school. According to the research findings, the most significant behavioral factor contributing to accidents is the failure of students to utilize Personal Protective Equipment (PPE) during practical training (46.25%). Other behavioral causes include joking with peers and not paying attention to the surrounding environmental conditions (12.5%), as well as not adhering to the proper procedures during laboratory/workshop practices (10%).

**Table 4.** Environmental Conditions Contributing to Accidents (N=80)

| No. | Question Variable | Number | Percentage (%) |
|---|---|---|---|
| 1 | Lack of Safety Measures on Stairs | 20 | 25 |
| 2 | No Safety Instructions in the School/Laboratory/Workshop Environment | 25 | 31.25 |
| 3 | Poorly Organized Practical Equipment in the Laboratory/Workshop | 13 | 16.25 |
| 4 | Practical Equipment in the Laboratory/Workshop Not Functioning Properly | 3 | 3.75 |
| 5 | The Laboratory/Workshop Lacks Adequate Lighting | 3 | 3.75 |
| 6 | The Laboratory/Workshop Floor is Slippery | 4 | 5 |
| 7 | No Safety Equipment | 3 | 3.75 |
| 8 | Other | 9 | 11.25 |

Table 4 demonstrates that the most prevalent environmental factors contributing to accidents among students include the absence of safety instructions in the laboratory/workshop (31.25%) and the lack of handrails on stairs (25%). Additionally, poorly organized practical equipment (16.25%) is also identified as a contributing factor to student accidents. To mitigate the occurrence of accidents among students while at school and in the laboratory, the school implements various measures, as illustrated in Table 5 below.

***Occupational Health and Safety Facilities in Schools and Laboratories/Workshops***

Data collection regarding OHS facilities in schools was conducted directly across nine VHS using a checklist. Table 5 below provides an overview of the availability of OHS facilities in the schools.

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**Table 5.** Availability of Occupational Health and Safety (OHS) Facilities in Schools (N=9)

| No. | Facilities | Number (n) | Percentage (%) |
|---|---|---|---|
| 1. | Standard Operating Procedures (SOP) / Safety Procedures | | |
| | - Yes | 1 | 11.1 |
| | - No | 8 | 88.9 |
| 2. | Safety Equipment in the Laboratory | | |
| | - Yes | 8 | 88.9 |
| | - No | 1 | 11.1 |
| 3. | Safety posters | | |
| | - Yes | 5 | 55.6 |
| | - No | 4 | 44.4 |
| 4. | First Aid Kits | | |
| | - Yes | 3 | 33.3 |
| | - No | 6 | 66.7 |
| 5. | Electrical panels with protective covers/safeguards | | |
| | - Yes | 3 | 33.3 |
| | - No | 6 | 66.7 |
| 6. | Personal Protective Equipment (PPE) for Practical Training | | |
| | - Yes | 8 | 88.9 |
| | - No | 1 | 11.1 |
| 7. | Designated Storage Areas for Equipment | | |
| | - Yes | 4 | 44.4 |
| | - No | 5 | 55.6 |
| 8. | Sinks with Running Water | | |
| | - Yes | 3 | 33.3 |
| | - No | 6 | 66.7 |

Table 5 indicates that the majority of schools do not apply Standard Operating Procedures (SOP) or safety procedures, and there are still schools that lack safety equipment. Nearly half of the schools do not display safety posters in the laboratory or school areas. The number of schools that do not provide first aid kits is greater than those that do. Furthermore, most schools do not equip electrical panels used for practical training with protective covers. While the majority of schools have provided Personal Protective Equipment (PPE), it remains limited and incomplete. Additionally, most practical equipment lacks designated storage areas, and the majority of laboratories/workshops do not have sinks with running water.

## Discussion

### *Identification of Accidents in Schools*

The identification of accidents in this study was conducted using a questionnaire administered directly to the respondents. It was found that 44.8% of students in grades XI and XII have experienced accidents. More than half of the respondents reported having suffered electric shocks during practical training in the laboratory/workshop. Practical activities are

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conducted at least twice a week for grade XI students and an average of four times a week for grade XII students. This condition potentially leads to students experiencing electric shocks more than once. Practical activities in the laboratory/workshop are carried out during the instructional period. Generally, both public and private VHS adopt a full-day learning system, with classes running from 8:00 AM to 3:00 PM, thereby aligning the timing of practical activities with the instructional hours. The research findings indicate that students experience accidents within this time frame.

Practical training in the laboratory/workshop at VHS in the Electrical Engineering and/or Electronics Engineering programs utilizes alternating current (AC) with a power capacity of 220 volts. AC electricity at this voltage level is classified as low current. Nevertheless, this type of electrical current remains hazardous if a person experiences an electric shock. Research indicates that electric shocks can lead to muscle cramps, numbness, muscle spasms, burns, and even cardiac shock, which can result in death [26–28]. The phenomenon observed in this study reveals that students are reluctant to report such accident incidents to their teachers. This reluctance is primarily due to the perception among students that experiencing an electric shock is a common occurrence and not particularly dangerous. Students tend to report accidents only in cases of electrical short circuits or incidents that result in severe consequences, such as a burned circuit breaker (MCB) or serious injuries.

Such an understanding is certainly inaccurate. An accident is an event that has the potential to cause loss[29]. This loss is not limited to material damage [30,31], but can also result in trauma [32], loss of workdays [33], psychological issues, and even lead to injuries, disabilities, or death [30]. The normalization of electric shocks must be a concern for schools and all related stakeholders, as electric shocks pose a significant health risk and can potentially result in fatal outcomes [28]. Furthermore, as future electrical technicians in the workplace, students will inevitably encounter electrical currents with higher capacities, thereby increasing the risk of accidents. Both students and supervising teachers in practical training need to be equipped with an understanding of the importance of OHS aspects. Any type of accident, whether minor, moderate, or severe, is an event that must be prevented and should not be normalized.

The domino theory posits that the direct causes of accidents are unsafe behaviors and unsafe conditions [17,29]. The findings of this research indicate that the primary unsafe behavior among students is the failure to utilize Personal Protective Equipment (PPE) during practical training. The PPE that should be worn during practical sessions includes safety shoes

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and rubber gloves, which possess insulating properties against electrical currents. The study found that the majority of students do not use PPE during practical training. The limited availability of PPE provided by the school and the economic factors affecting students are the main reasons for this situation. Furthermore, interviews with school officials revealed that the use of PPE is mandatory only during practical examinations, competency assessments at the end of the academic year, and when students participate in Industrial Work Practice (Prakerin). Another unsafe behavioral factor contributing to accidents among students is engaging in playful interactions with peers and failing to pay attention to the conditions in the laboratory/workshop.

During practical activities in the laboratory/workshop, instances of students joking with their peers have been observed. This behavior occurs because students feel unmonitored by their teachers and seek to alleviate boredom during practical sessions. Each practical activity in the electrical laboratory/workshop involves all students, with an average of 30 participants divided into 5 to 6 groups. The student-to-teacher ratio for practical supervision is 1:30. This condition results in insufficient oversight by the teacher. The lack of supervision and the tendency to joke during practical sessions, particularly in relation to electrical currents, constitute risk factors for accidents among students [34].

The environmental factors contributing to accidents identified in this study include the absence of safety instructions in the school/laboratory/workshop, disorganized practical equipment, and the lack of safety measures on stairs. The condition of the laboratory/workshop, which is cluttered with various electrical components and poorly arranged cables, undoubtedly poses a risk for accidents. Previous research indicates that work environments implementing the 5S principles (Sort, Set in order, Shine, Standardize, and Sustain) correlate with a reduction in workplace accidents [35]. Instructors supervising practical sessions need to develop SOP for the application of 5S in the laboratory. Incorporating the 5S elements into the assessment criteria for practical work can serve as an alternative to create a clean laboratory/workshop environment that is free from unsafe conditions. Additionally, instilling safe working habits among students in accordance with the SOP is essential for reducing the risk of accidents.

***Occupational Health and Safety (OHS) Facilities in Schools and Laboratories/Workshops***

As the research findings indicate, the majority of the factors contributing to accidents are attributed to the absence of safety instructions in the workshop/laboratory. In this study, safety instructions pertain to the availability of safety procedures and safety posters. Observational findings also indicate that only 55.5% of schools have installed safety posters in their

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laboratories/workshops. Overall, the OHS facilities available in the schools are categorized as incomplete. Among the eight elements of facilities that were observed, no school was found to possess all of these elements.

The Occupational Health and Safety (OHS) facilities required by schools to prevent accidents include Safety Procedures and SOP, safety instructions in the form of safety signs, the installation of safety equipment in laboratories, the provision of first aid kits, the installation of protective covers on electrical panels, the provision of PPE, designated storage areas for equipment, and the availability of sinks with running water. In terms of hierarchy, accident control can be implemented starting from the most effective measures: elimination, substitution, engineering controls, administrative controls, and the use of personal protective equipment [36]. If elimination and substitution cannot be applied, the control measures can begin with engineering controls, administrative controls, and personal protective equipment. These three control measures can be comprehensively implemented to prevent accidents during students' practical training in workshops/laboratories (Angriani, 2025). The OHS facilities in this study represent components of the technical control hierarchy.

The installation of safety equipment in the laboratory, the provision of protective covers for electrical panels, the establishment of designated storage areas for equipment, the availability of first aid kits, and the provision of sinks with running water are components of technical accident control. The establishment of safety procedures and SOP, as well as the presence of safety instructions, constitutes administrative control measures. The use and provision of PPE represent the final stage of control that can be implemented in conjunction with other control measures.

Based on observations, it is evident that the most commonly lacking OHS facilities in schools are safety procedures and SOP. The majority of schools do not possess SOPs or safety procedures. Standard Operating Procedures (SOP) are documents that outline the steps for performing tasks safely and securely. The electrical laboratories/workshops in VHS should be equipped with both SOPs and safety procedures, which serve as guidelines for students during practical activities. SOPs and safety procedures significantly aid in preventing accidents and must be an integral part of the safety management system within schools [38].

The Occupational Health and Safety (OHS) facilities that are still largely absent in schools include First Aid Kits (P3K) and their contents. A First Aid Kit is a container that holds basic medical supplies such as bandages, sterile gauze, adhesive tape, antiseptics, and scissors [39]. These basic medical supplies are intended to provide initial assistance in the event that a student

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sustains an injury or experiences an accident before receiving further medical care. Although previous research statistically indicates no correlation between the ability to manage first aid and the occurrence of accidents [40], schools are nonetheless required to provide First Aid Kits in laboratories/workshops. This provision is aimed at mitigating the severity of injuries should an accident occur among students.

Based on the type of accidents most frequently experienced by VHS students, namely electric shocks, both intentional and unintentional, it is imperative for schools to provide protective covers for the electrical panels used during practical training. Survey results indicate that the majority of schools do not provide protective covers for electrical panels. This condition undoubtedly constitutes a risk factor for accidents among students. Open electrical panels that remain energized can be touched by students at any time. The potential for injury increases when students do not wear rubber gloves or when their hands are wet. Therefore, preventive measures can be implemented by installing protective covers, incorporating Miniature Circuit Breakers (MCB), conducting routine cable inspections, and providing protection against electrical heat [41].

## Conclusion

The most unsafe action in VHS students in the Electrical Engineering and/or Electronics Engineering programs such as the failure to use PPE during practical training. The predominant environmental factor leading to accidents is the absence of safety instructions and SOP in the laboratory. This situation is further exacerbated by the limited availability of OHS facilities within the schools.

## Recomendation

This study recommends the necessity of enhancing the availability of supporting OHS infrastructure in schools, particularly safety signs, and the development of safety procedures to prevent potential accidents for both students and teachers. Schools should mandate the use of rubber gloves by students during practical training.

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