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Evaluative Study of Laboratory Hazards and Safety Interventions in School

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Abstract

This study, entitled *"Evaluative Study of Laboratory Hazards and Safety Interventions in School,"* aimed to identify the specific hazards present in school laboratories, assess the safety interventions currently implemented, evaluate their effectiveness in reducing risks, and propose improvements to strengthen laboratory safety. The study focused on the Senior High School Technical-Vocational-Livelihood (TVL) laboratories of Muñoz National High School.

The study employed a descriptive-evaluative research design using both quantitative and qualitative approaches. The respondents consisted of 10 Grade 11 and Grade 12 TVL students and 5 teachers selected through purposive and random sampling techniques. Data were gathered through online questionnaires using a five-point Likert scale, focus group discussions (FGDs), and an observation checklist. Quantitative data were analyzed using frequency distribution, percentage, and weighted mean, while thematic analysis was used for qualitative responses.

The findings revealed that respondents demonstrated a very high level of awareness regarding laboratory hazards, with an overall mean of 4.41 interpreted as "Strongly Agree." The commonly identified hazards included physical, chemical, biological, electrical, and fire-related risks. Safety interventions such as safety orientation, use of personal protective equipment (PPE), safety reminders, and the availability of fire extinguishers were generally well implemented, obtaining an overall mean of 4.21, interpreted as "Strongly Agree." The effectiveness of these interventions was also positively perceived, with an overall mean of 3.81 interpreted as "Agree," indicating that safety measures contribute significantly to reducing laboratory hazards and preventing accidents. Moreover, respondents strongly supported improvements such as regular safety training, stricter enforcement of laboratory rules, improved availability of safety equipment, and regular maintenance of laboratory facilities, reflected by an overall mean of 4.45, interpreted as "Strongly Agree."

The study concluded that although school laboratories have existing safety interventions that are generally effective, inconsistencies in implementation and resource availability remain evident. Therefore, continuous improvement, regular safety training, proper monitoring, and strengthened safety practices are necessary to ensure a safer and more conducive laboratory learning environment.

Keywords: Laboratory Hazards, Safety Interventions, Laboratory Safety, TVL Laboratories, School Safety, PPE, Safety Training

Introduction

The laboratory plays an important role in students' learning and enhancing skills. However, laboratories have their own hazards, such as chemical exposure, electrical risks, improper equipment handling, and unsafe laboratory practices. These hazards require proper management with safety measures to protect both teachers and students from potential harm.

Evaluating laboratory hazards in schools is necessary because it helps identify potential threats and assess whether existing safety measures can prevent accidents and injuries.

Recent literature emphasizes that TVL laboratory environments are inherently risk-laden due to the nature of hands-on training. Students are frequently exposed to mechanical hazards (e.g., cuts, entanglement, and equipment misuse), electrical risks (e.g., faulty wiring and improper handling of powered tools), and ergonomic strain resulting from repetitive or physically demanding tasks (International Labor Organization [ILO], 2022) [5]. In addition, the use of cleaning agents, fuels, and other materials introduces chemical exposure risks that may affect student health when safety protocols are not strictly followed

(Occupational Safety and Health Administration [OSHA], 2023) [8]. Empirical findings suggest that minor injuries and near-miss incidents are relatively common in training environments, particularly when safety procedures are inconsistently applied (Muiruri & Muteti, 2021) [7].

One common theme in the recent literature is the gap between safety awareness and practice. Although students receive training on laboratory rules and procedures, compliance is known to deteriorate with time due to familiarity with tasks as well as overconfidence or lack of supervision (Alqahtani et al., 2022) [1]. Instructors, though, can be constrained by the realities of large class sizes, time, and lack of institutional support that hinder enforcement of safety policies (Gonzales & amp; Ramirez, 2023) [4]. The results indicated that awareness of safety rules is not sufficient for safe behavior, and compliance must be supported, monitored, and reinforced on a regular basis.

To reduce risks, schools and other places put in place safety measures that can be grouped into three main areas: management, technical, and human factors. Management safety measures include having clear rules, standard ways of doing things, and good supervision. Technical safety measures involve providing the right equipment, like protective gear, and making sure machines and labs are designed safely. Human factors focus on teaching people the right skills, promoting good attitudes, and encouraging responsible behavior. Research shows that even when schools have safety rules and provide equipment, these measures only work if people actually follow them all the time. If not, they aren't as effective as they could be. For example, just having a safety policy isn't enough - it's how well it's put into practice that really matters.

Schools face a big problem when it comes to teaching students how to work safely. They need to make sure their training is similar to what's done in real workplaces, but this can be hard to do. One reason is that schools, especially public ones, often don't have enough money to buy new equipment or fix up their facilities. This means that the places where students learn can be unsafe, which is a big concern. For example, laboratories in schools might not have good ventilation or enough safety devices, which can lead to accidents. This is something that has been noticed by researchers, who say that these issues can make it more likely for students to get hurt. Schools need to find a way to deal with these problems so they can provide a safe learning environment for their students.

Recent studies show that teaching safety as part of everyday lessons is more effective than just doing a one-time orientation. Ongoing training that focuses on building skills, such as learning by doing, practicing with guidance, and using simulations, has been proven to increase awareness of safety rules and make sure people follow them. But schools are using these methods in different ways, and we don't know enough about how well they work in vocational training programs for high school students.

There's a big gap in research on safety in school labs, especially in Senior High School TVL laboratories. Most studies focus on colleges or workplaces, but not on schools. This is a problem in the Philippines, where schools have different resources and ways of doing things, which can affect how safe they are. We need more studies that look at safety in school labs, so we can understand what works and what doesn't, and make our schools safer for students.

In response to this need, the present study, titled "Evaluative Study of Laboratory Hazards and Safety Interventions in School," seeks to provide a context-specific assessment of laboratory safety. It aims to identify the types of hazards encountered by students, evaluate the implementation of safety interventions, and determine their effectiveness in promoting a safe and conducive learning environment.

These recent studies show that safety measures are in place in many training settings, but how well they work depends on several factors. These include the support of the institution, the resources available, and how people behave. In laboratories where students learn technical and vocational skills, there are many different kinds of hazards, and some of them can't be completely avoided. However, the impact of these hazards can be reduced if safety measures are put in place consistently, implemented well, and tailored to the specific context. This study takes a closer look at how these safety measures work in a particular senior high school setting, which is an important part of understanding how to keep students safe. By evaluating the effectiveness of safety measures in this context, we can identify areas for improvement and work towards creating a safer learning environment.

Objectives of the Study/ Statement of the Problems

- What types of laboratory hazards are present in school laboratories?
- What safety interventions are currently implemented to address these hazards?
- The effectiveness of safety interventions shows their ability to reduce laboratory hazards through their protective functions.
- What improvements can be recommended to enhance laboratory safety in schools?

Conceptual Framework

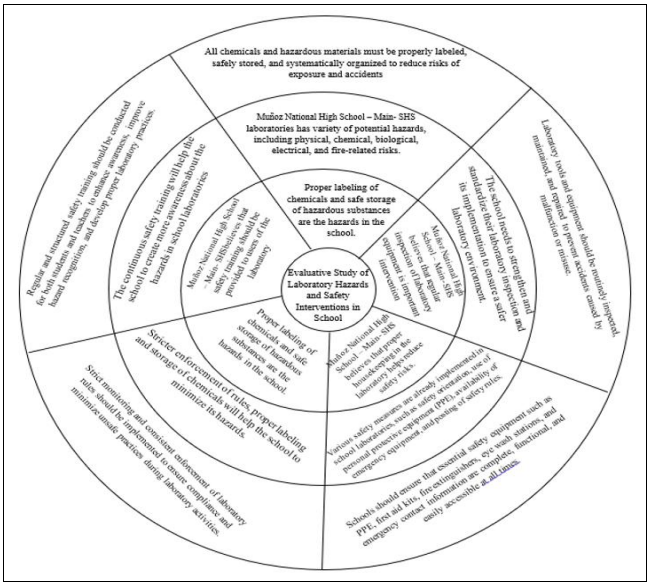

Fig 1: Web Scheme

Significance of the Study

The results of this study will be beneficial to the following:

1. Learners: This study will benefit students by increasing their awareness of laboratory hazards and promoting safe work habits that are essential for future workplace readiness.

2. Teachers and Laboratory Instructors: The results of this study may be used to strengthen supervision, improve safety instruction, and reinforce proper laboratory practices.
3. School Administrators: The study provides useful information for assessing current safety policies, facilities, and resource allocation, supporting informed decisions to improve laboratory conditions.
4. Community and Parents: Through this research, parents and members of the community have the potential to become inspired to support the school in creating a safe environment for students in minimizing laboratory hazards.
5. Future Researchers: This study will serve as a reference for future studies in the analysis of similar issues or topics on the evaluation of safety and hazards.

Scope and Limitation

This study focuses on the evaluation of laboratory hazards and safety interventions in a selected Senior High School Technical-Vocational-Livelihood (TVL) laboratory setting. It examines the common hazards encountered by students during laboratory activities, including mechanical, electrical, chemical, and ergonomic risks. The study also evaluates the safety interventions implemented by the school, which are categorized into management, technical, and human safety measures.

The respondents of the study include Senior High School TVL students and selected teachers or laboratory instructors who are directly involved in laboratory activities. Data are gathered through an online questionnaire administered via Google Forms and an online focus group discussion (FGD) to collect perceptions, experiences, and safety practices related to laboratory use. The study is limited to assessing the effectiveness of existing safety measures based on self-reported data and does not include physical inspections, accident investigations, or experimental interventions.

This study has several limitations that should be considered when interpreting the results. First, data collection relies solely on self-reported responses through online questionnaires and virtual focus group discussions, which may be affected by recall bias, social desirability bias, or respondents' willingness to provide accurate information. Second, the absence of on-site laboratory observation limits the ability to verify actual safety practices, equipment conditions, and facility compliance.

Additionally, the study is confined to one Senior High School TVL setting and may not fully represent the conditions of other schools with different resources, facilities, or institutional support. Limited internet access, technological challenges, and participant availability during online data collection may also affect response rates and the depth of discussion. Lastly, the study does not measure long-term safety outcomes or actual injury rates but focuses only on perceived hazards and the reported effectiveness of safety interventions at the time of data collection.

Definition of Terms

- **Emergency Equipment** includes essential tools and devices for urgent situations in the lab - fire extinguishers, first aid kits, and eye wash stations empower everyone to act confidently and protect one another.
- **Evaluation** - refers to the process of determining and judging hazards and interventions in the laboratory.
- **Laboratory Hazards -** refers to any potential source of danger in school laboratories that may cause harm, injury, or accidents to students and teachers. These include physical, chemical, biological, electrical, and fire hazards.
- **Personal Protective Equipment (PPE)** refers to protective materials such as gloves, goggles, lab coats, and masks used by students and teachers to minimize exposure to hazards during laboratory activities.
- **Safety Inspection** - refers to the regular checking and evaluation of laboratory equipment and facilities to ensure they are safe, functional, and compliant with safety standards.
- **Safety Interventions -** refers to all preventive and protective measures implemented in school laboratories to reduce or eliminate risks. These include safety rules, PPE use, safety training, emergency equipment, and safety reminders.

Methodology

Research Design

The researchers applied a step-by-step process in order to come up with an output that will meet the research problem.

First, we created research questions anchored in the research problem, and it was administered using the Google Form link to learners and teachers at Muñoz National High School – Main – Senior High School to measure the frequency with which they evaluate the laboratory hazards and safety interventions in their school. The questionnaire consisted of both closed-ended items using a five-point Likert scale and open-ended questions.

Second, a focus group discussion (FGD) was conducted to help the researchers gather the answers of the respondents and the necessary information needed in the study. This method provided a structured yet flexible setting where participants can openly share their lived experiences, perceptions, and reflections regarding laboratory hazards and the implementation of safety interventions in Muñoz National High School – Main – Senior High School.

Third, the researchers created an observation checklist that was given to the teachers and learners to validate the research findings and ensure that the relevant information gathered is reliable.

Lastly, the gathered data was then interpreted using statistical tools, which answered the research problem.

Research Locale

Fig 2: Map of Science City of Muñoz and Muñoz National High School Main SHS Building

The study was conducted in Muñoz National High School Main Senior High School, a public secondary school situated in Brgy. Bantug, Science City of Muñoz, Nueva

Ecija. The school operates under the supervision of the Department of Education (DepEd) - Division of Science City of Muñoz.
The school is an ideal locale for the study because Muñoz is the first and only Science City in the Philippines that has a large offering in Technical Vocational Livelihood Tracks.

Research Respondents
The participants in this study were 10 learners from grades 11 and 12 and 5 teachers from Muñoz National High School - Main - Senior High School, selected through purposive sampling, who are directly engaged in Technical Vocational Livelihood (TVL) laboratory activities and supervision. They actively engage, share personal experiences, opinions, and reflections in focus group discussions about their school's laboratory hazards and safety interventions.
The study utilized simple random sampling in selecting the student respondents to ensure that every Grade 11 and Grade 12 TVL learner has an equal opportunity of being chosen. This approach helps minimize bias and promotes fairness in participant selection. For teacher respondents, selection was also done randomly among available TVL instructors.

Data Gathering Tools and Techniques
The researchers' data gathering tools and techniques involve a structured questionnaire to gather initial data about laboratory dangers and current safety measures from laboratory users who are students and teachers. The questionnaire had both closed-ended items for quantitative analysis and open-ended items for qualitative insights. After this, the research team gathered qualitative data about laboratory hazards and safety interventions through a Focus Group Discussion (FGD), where we collected opinions and experiences from chosen study participants. The researchers employed an observation checklist to evaluate the school's laboratory hazards and safety interventions. The researchers used statistical methods to analyze collected data, which includes frequency counts and percentages, and means for quantitative data, and thematic analysis for qualitative responses, to achieve a complete understanding of laboratory hazards and safety interventions.

Statistical Tools or Method of Analysis
The researchers applied descriptive statistics to analyze questionnaire data through frequency counts. percentage calculations, and weighted mean calculations to assess laboratory hazard prevalence and safety intervention effectiveness. The weighted mean will provide an overall assessment of the respondents' perceptions and the observed compliance with safety interventions. The research team will analyze qualitative data from interviews and Focus Group Discussions (FGDs) through thematic analysis, which includes the identification and coding of themes that show common patterns about laboratory hazards and safety practices and recommendations for improvement. The study combines quantitative methods with qualitative methods to deliver a complete assessment of laboratory hazards and the effectiveness of school laboratory safety interventions.
The data gathered in this study, entitled "Evaluative Study of Laboratory Hazards and Safety Interventions in School" **were** processed using the following statistical tools:
Frequency Distribution- was used to systematically list the values of the variables by using categories or information.

Percentage - was utilized by the researchers.

Weighted Mean- The researchers calculated the results of the 1-5-point Likert scale survey questionnaire using a weighted mean. The weighted mean can estimate a theoretically expected outcome when each alternative has a distinct probability of occurring in various scenarios. The weighted mean is computed by multiplying each data point in a set by a weight based on its contribution to a specific aspect of the data.
Formula:

$$\mathbf{P = (F/N) \times 100}$$

Where in:
P = percentage
F = frequency
N = total population

Weighted Mean-The tool is used to answer questions about "Evaluative Study of Laboratory Hazards and Safety Interventions in School."
The formula is given below:
Formula:

$$\mathbf{WM} = \frac{\mathbf{TWF}}{\mathbf{N}}$$

Where in:
WM = Weighted Mean
TWF = Total Weighted Frequency
N = Population size to describe the weighted mean and interpret the result of each item, the following arbitrary scales were applied:

Rating Scales

5	4.21-5.00	Strongly Agree
4	3.41-4.20	Agree
3	2.61-3.40	Moderately Agree
2	1.81-2.60	Disagree
1	1.00-1.80	Strongly Disagree

Ethical Considerations
The study used a voluntary participation model, which provides full disclosure to all respondents about the research objectives or research problem and the subsequent use of their collected data. The research team obtained informed consent before they started collecting data, while participants maintained the option to leave the research study at any time without facing any penalties. The study protected all respondents' privacy rights by not allowing any personal details or specific individual answers to be shared outside of research purposes. The researchers executed their data collection activities, which include questionnaires and focus group discussions, with complete respect for all participants to protect them from any physical, emotional, or psychological harm. The research study adhered to school regulations by securing all required permissions from school administrators, which enabled the study to proceed ethically and safely.

Results and Discussions

Table 1: Types of Laboratory Hazards Present in School Laboratories

Item No.	N=15	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Level
1.	Laboratory hazards in school laboratories can cause serious accidents if not properly managed. *(Ang mga panganib sa laboratoryo ng paaralan ay maaaring magdulot ng malubhang aksidente kung hindi maayos na napamamahalaan.)*	10 (66.67%)	3 (20%)	2 (13.33%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
2.	Students are exposed to physical hazards such as broken glass, heat, and sharp objects in the laboratory. *(Ang mga mag-aaral ay nalalantad sa mga pisikal na panganib tulad ng basag na salamin, init, at matutulis na bagay sa laboratoryo.)*	6 (40%)	5 (33.33%)	4 (26.67%)	0 (0%)	0 (0%)	**4.13**	**Agree**
3.	Chemical substances used in laboratories can be dangerous if not handled correctly. *(Ang mga kemikal na ginagamit sa laboratoryo ay maaaring maging mapanganib kung hindi wasto ang paghawak.)*	7 (46.66%)	6 (40%)	2 (13.33%)	0 (0%)	0 (0%)	**4.33**	**Strongly Agree**
4.	Biological materials in school laboratories may pose health risks to students and teachers. *(Ang mga biological na materyales sa laboratoryo ay maaaring magdulot ng panganib sa kalusugan ng mga mag-aaral at guro.)*	7 (46.66%)	6 (40%)	2 (13.33%)	0 (0%)	0 (0%)	**4.33**	**Strongly Agree**
5.	Electrical equipment in laboratories can cause accidents if safety procedures are not followed. *(Ang mga kagamitang elektrikal sa laboratoryo ay maaaring magdulot ng aksidente kung hindi sinusunod ang mga safety procedure.)*	9 (60%)	5 (33.33%)	1 (6.67%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
6.	Fire hazards are always present in school laboratories due to the use of heat and flammable materials. *(Palaging may panganib ng sunog sa mga laboratoryo ng paaralan dahil sa paggamit ng init at madaling magliyab na materyales.)*	6 (40%)	4 (26.67%)	4 (26.67%)	1 (6.67%)	0 (0%)	**4.00**	**Agree**
7.	Proper housekeeping in the laboratory helps reduce safety risks. *(Ang maayos na kalinisan sa laboratoryo ay nakatutulong upang mabawasan ang mga panganib sa kaligtasan.)*	12 (80%)	1 (6.67%)	1 (6.67%)	1 (6.67%)	0 (0%)	**4.60**	**Strongly Agree**
8.	Improper use of laboratory equipment increases the risk of accidents. *(Ang maling paggamit ng mga kagamitan sa laboratoryo ay nagpapataas ng panganib ng aksidente.)*	8 (53.33%)	4 (26.67%)	3 (20%)	0 (0%)	0 (0%)	**4.33**	**Strongly Agree**
9.	Safety signs and emergency equipment are important in preventing laboratory accidents. *(Mahalaga ang mga safety sign at emergency equipment sa pag-iwas sa mga aksidente sa laboratoryo.)*	11 (73.33%)	4 (26.67%)	0 (0%)	0 (0%)	0 (0%)	**4.73**	**Strongly Agree**
10.	Laboratory safety training should be regularly conducted for students and teachers. *(Dapat regular na isinasagawa ang pagsasanay sa kaligtasan sa laboratoryo para sa mga mag-aaral at guro.)*	9 (60%)	6 (40%)	0 (0%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
Types of Laboratory Hazards Present in School Laboratories							**4.41**	**Strongly Agree**

The results of the study in the first part of the table focused on identifying the types of laboratory hazards present in school laboratories, including physical, chemical, biological, electrical, and fire hazards. The findings also examined the level of awareness of both students and teachers regarding these laboratory hazards, providing insight into their understanding and preparedness in handling laboratory-related risks. In addition, the results determined the most commonly observed hazards based on the perceptions of the respondents, highlighting which safety concerns are most frequently encountered in the school setting. The study further evaluated how existing laboratory conditions and practices contribute to the occurrence of such hazards, emphasizing areas that may require improvement.

The data reveal that respondents have a very high level of awareness regarding the different types of laboratory hazards present in school laboratories, as reflected by the overall mean of 4.41, interpreted as "Strongly Agree." This indicates that the respondents generally recognize that laboratory environments pose significant safety risks if not properly managed. Among all the indicators, the research question number 9, *"Safety signs and emergency equipment are important in preventing laboratory accidents,"* obtained the highest mean of 4.73 (Strongly Agree), showing a strong consensus on the importance of preventive safety measures.res. This suggests that respondents highly value visible safety protocols and emergency preparedness in minimizing risks.

Similarly, *"Proper housekeeping in the laboratory helps reduce safety risks"* and *"Laboratory safety training should be regularly conducted"* both received high means of 4.60 (Strongly Agree), indicating that respondents strongly believe in the role of cleanliness, organization, and continuous training in ensuring laboratory safety.

Items related to electrical hazards (4.53) and general accident risks due to poor hazard management (4.53) were also rated "Strongly Agree," highlighting that respondents are highly aware of the dangers posed by improper handling of electrical equipment and unmanaged risks.

Statements concerning biological hazards (4.33), chemical hazards (4.33), and improper use of equipment (4.33) were also rated "Strongly Agree," suggesting that respondents recognize multiple categories of hazards and their potential impact on health and safety.

On the other hand, *"Students are exposed to physical hazards"* (4.13) and *"Fire hazards are always present"* (4.00) were rated slightly lower, though still within the "Agree" level. This may indicate that while respondents acknowledge these risks, they may perceive them as less frequent or less severe compared to other hazards.

Overall, the findings imply that respondents have a comprehensive understanding of laboratory hazards, particularly emphasizing the importance of preventive measures, proper training, and safety compliance. However, slight variations in the level of agreement suggest that certain hazards (e.g., fire and physical hazards) may require further emphasis or awareness programs to ensure consistent recognition of all potential risks.

Part II: Safety Interventions Currently Implemented to Address Hazards

Item No.	N=15	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Level
1.	Laboratory safety rules are posted and visible *(Nakapaskil at malinaw na nakikita ang laboratory safety rules)*	6 (40%)	7 (46.66%)	1 (6.67%)	0 (0%)	1 (6.67%)	**4.13**	**Agree**
2.	Safety orientation is conducted before lab activities *(May isinasagawang safety orientation bago ang laboratory activities)*	8 (53.33%)	6 (40%)	1 (6.67%)	0 (0%)	0 (0%)	**4.47**	**Strongly Agree**
3.	Use of Personal Protective Equipment (PPE) is enforced *(Ipinapatupad ang paggamit ng Personal Protective Equipment (PPE)*	10 (66.67%)	3 (20%)	1 (6.67%)	0 (0%)	1 (6.67%)	**4.40**	**Strongly Agree**
4.	Availability of PPE (gloves, goggles, lab coats) *(May sapat na PPE (gloves, goggles, lab coat))*	5 (33.33%)	6 (40%)	3 (20%)	0 (0%)	1 (6.67%)	**3.93**	**Agree**
5.	Presence of first aid kits (*Mayroong first aid kit sa laboratory)*	6 (40%)	5 (33.33%)	3 (20%)	0 (0%)	1 (6.67%)	**4.00**	**Agree**
6.	Availability of fire extinguishers *(Mayroong fire extinguisher na magagamit)*	9 (60%)	6 (40%)	0 (0%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
7.	Emergency exits are clearly marked *(Malinaw na nakamarka ang emergency exits)*	7 (46.66%)	6 (40%)	1 (6.67%)	1 (6.67%)	0 (0%)	**4.27**	**Strongly Agree**
8.	Proper labeling of chemicals and materials *(Maayos ang paglalagay ng label sa mga kemikal at kagamitan)*	5 (33.33%)	8 (53.33%)	1 (6.67%)	0 (0%)	1 (6.67%)	**4.07**	**Agree**
9.	Safe storage of hazardous substances *(Ligtas ang pag-iimbak ng mga mapanganib na kemikal)*	5 (33.33%)	8 (53.33%)	0 (0%)	2 (13.33%)	0 (0%)	**4.07**	**Agree**
10.	Regular inspection of laboratory equipment *(Regular na sinusuri ang mga kagamitan sa laboratory)*	5 (33.33%)	8 (53.33%)	1 (6.67%)	1 (6.67%)	0 (0%)	**4.13**	**Agree**
Safety Interventions Currently Implemented TO Address Hazards							**4.21**	**Strongly Agree**

The results of the study from the second table addressed the following objectives: to identify the existing safety interventions implemented in school laboratories, such as safety rules, use of personal protective equipment (PPE), and availability of emergency equipment; to assess the extent to which these safety interventions are practiced and enforced; to determine the availability and accessibility of laboratory safety equipment and facilities; and to evaluate the implementation of safety procedures, including safety orientation, training, and regular inspections. Overall, the findings provide an evaluation of how safety measures are applied in school laboratories and the extent to which they are effectively practiced and maintained.

The data indicate that safety interventions in school laboratories are generally well implemented, as reflected by the overall mean of 4.21, interpreted as "Strongly Agree." This suggests that respondents perceive that various safety measures are actively practiced to address laboratory hazards.

Among the indicators, *"Availability of fire extinguishers"* obtained the highest mean of 4.60 (Strongly Agree), indicating that respondents strongly affirm the presence and accessibility of fire safety equipment in laboratories. This reflects a high level of preparedness for fire-related emergencies.

Similarly, *"Safety orientation is conducted before lab activities"* (4.47) and *"Use of Personal Protective Equipment (PPE) is enforced"* (4.40) were also rated Strongly Agree, suggesting that preventive practices such as orientation and enforcement of safety protocols are consistently implemented. These findings highlight the importance given to proactive safety measures in minimizing risks.

The indicators *"Emergency exits are clearly marked"* (4.27) and *"Laboratory safety rules are posted and visible"* (4.13) further support that safety information and emergency guidance are generally accessible and communicated within the laboratory setting.

However, several indicators received slightly lower ratings, interpreted as "Agree," such as *"Availability of PPE"* (3.93), *"Presence of first aid kits"* (4.00), *"Proper labeling of chemicals"* (4.07), *"Safe storage of hazardous substances"* (4.07), and *"Regular inspection of laboratory equipment"* (4.13). While still positive, these results suggest that these safety interventions may not be consistently or fully implemented across all laboratories.

Notably, the presence of some responses under neutral and disagree categories in these items indicates minor gaps or inconsistencies in the provision of resources (e.g., PPE), maintenance practices, and safety management procedures.

Overall, the findings imply that while core safety interventions are in place and widely recognized, there is still a need to strengthen consistency and completeness in certain areas, particularly in resource availability, equipment inspection, and proper chemical management. Enhancing these aspects could further improve the overall effectiveness of laboratory safety practices.

Part III. The Effectiveness of Safety Interventions Shows Ability to Reduce Laboratory Hazards Through Protective Functions

Item No.	N=15	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Level
1.	Safety interventions reduce the occurrence of laboratory hazards. *(Nababawasan ng mga safety interventions ang paglitaw ng mga panganib sa laboratoryo.)*	8 (53.33%)	5 (33.33%)	2 (13.33%)	0 (0%)	0 (0%)	**4.40**	**Strongly Agree**
2.	Safety interventions are effective in preventing laboratory accidents. *(Epektibo ang mga safety interventions sa pagpigil ng aksidente sa laboratoryo.)*	8 (53.33%)	6 (40%)	1 (6.67%)	0 (0%)	0 (0%)	**4.47**	**Strongly Agree**
3.	Personal protective equipment (PPE) effectively reduces laboratory hazards. *(Epektibo ang PPE sa pagbawas ng panganib sa laboratoryo.)*	10 (66.67%)	4 (26.67%)	1 (6.67%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
4.	Safety training enhances awareness of laboratory hazards. *(Napapataas ng safety training ang kamalayan tungkol sa panganib sa laboratoryo.)*	9 (60%)	6 (40%)	0 (0%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
5.	Safety reminders reinforce safe laboratory practices. *(Napapatibay ng mga safety reminders ang ligtas na gawain sa laboratoryo.)*	9 (60%)	6 (40%)	0 (0%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
6.	Safety inspections help identify and control laboratory hazards. *(Nakakatulong ang mga safety inspection sa pagtukoy at pagkontrol ng panganib sa laboratoryo.)*	9 (60%)	5 (33.33%)	1 (6.67%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
7.	Safety measures fail to prevent laboratory accidents. *(Hindi napipigilan ng mga safety measures ang mga aksidente sa laboratoryo.)*	4 (26.67%)	1 (6.67%)	2 (13.33%)	5 (33.33%)	3 (20%)	**2.87**	**Neutral**
8.	Personal protective equipment (PPE) is not effective in reducing laboratory hazards. *(Hindi epektibo ang PPE sa pagbawas ng panganib sa laboratoryo.)*	4 (26.67%)	1 (6.67%)	1 (6.67%)	3 (20%)	6 (40%)	**2.60**	**Disagree**
9.	Safety training do not increase awareness of laboratory hazards. *(Hindi napapataas ng safety training ang kamalayan tungkol sa panganib sa laboratoryo.)*	4 (26.67%)	1 (6.67%)	1 (6.67%)	5 (33.33%)	4 (26.67%)	**2.73**	**Neutral**
10.	Safety reminders and inspections are not effective in reinforcing safe laboratory practices. *(Hindi epektibo ang mga safety reminders sa pagpapatibay ng ligtas na gawain sa laboratoryo.)*	4 (26.67%)	1 (6.67%)	1 (6.67%)	4 (26.67%)	5 (33.33%)	**2.67**	**Neutral**
The Effectiveness of Safety Interventions Shows Ability to Reduce Laboratory Hazards Through Protective Functions.							**3.81**	**Agree**

The results of the study from the third table focused on assessing the extent to which safety interventions reduce the occurrence of laboratory hazards; determining the effectiveness of safety interventions in preventing laboratory accidents; evaluating the role of personal protective equipment (PPE) in minimizing laboratory risks; assessing how safety training and safety reminders enhance awareness and promote safe laboratory practices; examining the effectiveness of safety inspections in identifying and controlling laboratory hazards; and identifying areas where safety interventions may be insufficient or require improvement. Overall, the findings provide an evaluation of how safety measures contribute to hazard prevention and laboratory safety management.

The data show that safety interventions are perceived to be generally effective in reducing laboratory hazards, as reflected by the overall mean of 3.81, interpreted as "Agree." This indicates that respondents believe safety measures contribute positively to minimizing risks, although the level of agreement is slightly lower compared to the previous tables, suggesting some reservations or inconsistencies.

Most of the positively stated indicators received "Strongly Agree" ratings, demonstrating strong confidence in the effectiveness of safety interventions. Specifically, *"Personal protective equipment (PPE) effectively reduces laboratory hazards," "Safety training enhances awareness,"* and *"Safety reminders reinforce safe practices"* all obtained the highest mean of 4.60 (Strongly Agree). This implies that respondents highly recognize the role of PPE, training, and continuous reminders in promoting laboratory safety.

Similarly, *"Safety interventions are effective in preventing laboratory accidents"* (4.47), *"Safety interventions reduce the occurrence of hazards"* (4.40), and *"Safety inspections help identify and control hazards"* (4.53) were all rated Strongly Agree, further confirming that respondents perceive these interventions as reliable and impactful in preventing accidents and managing risks.

However, the negatively worded statements (Items 7-10) yielded lower mean scores ranging from 2.60 to 2.87, interpreted as Neutral to Disagree. For instance, *"PPE is not effective"* (2.60-Disagree) indicates that respondents generally reject this statement, reinforcing the earlier finding that PPE is indeed effective. Meanwhile, items such as *"Safety measures fail to prevent accidents"* (2.87-Neutral), *"Safety trainings do not increase awareness"* (2.73-Neutral), and *"Safety reminders and inspections are not effective"* (2.67-Neutral) show mixed responses.

These neutral responses suggest that while many respondents disagree with the negative statements, some

uncertainty or variability in perceptions still exists, possibly due to differences in actual implementation, experience, or exposure to safety practices.

Overall, the findings indicate that respondents acknowledge the effectiveness of safety interventions, particularly in terms of PPE use, training, and safety monitoring. However, the presence of neutral responses in negatively framed items implies a need to further strengthen the consistency, visibility, and perceived reliability of these interventions to ensure stronger and more uniform confidence among all respondents.

Part IV. Recommended Improvements to Enhance Laboratory Safety in Schools

Item No.	N=15	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Level
1.	Safety equipment (e.g., eye wash, fire extinguisher, first aid kit) should be available, and the emergency phone numbers to call are visible and accessible in case of a fire. *(Ang mga kagamitang pangkaligtasan (hal. panghugas ng mata, pamatay-sunog, kahon ng pangunang lunas) ay dapat na madaling makuha, at ang mga numerong tatawagan sa oras ng emerhensiya ay malinaw na nakikita at madaling makuha sakaling magkaroon ng sunog.*	8 (53.33%)	7 (46.66%)	0 (0%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
2.	Make ventilation systems (fume hoods) fully functional and regularly tested. *(Tiyaking ganap na gumagana ang mga sistema ng bentilasyon (mga fume hood) at regular na sinusuri.)*	5 (33.33%)	10 (66.67%)	0 (0%)	0 (0%)	0 (0%)	**4.33**	**Strongly Agree**
3.	The lab layout should be posted for safe movement during emergencies. *(Ang plano o ayos ng laboratoryo ay dapat na nakapaskil upang masiguro ang ligtas na paggalaw sa panahon ng emerhensiya.)*	8 (53.33%)	7 (46.66%)	0 (0%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
4.	Chemicals and materials should be properly labeled and secured, and should be stored properly after the activities. (*Ang mga kemikal at materyales ay dapat maayos na may label at ligtas na nakaimbak, at itinatago sa tamang paraan pagkatapos ng mga gawain.)*	6 (40%)	9 (60%)	0 (0%)	0 (0%)	0 (0%)	**4.40**	**Strongly Agree**
5.	The use of Personal Protective Equipment (PPE) *(e.g., gloves, goggles, lab coats) is available and* should be strictly enforced. *(Ang paggamit ng Personal Protective Equipment (PPE) (hal. guwantes, goggles, lab coat) ay maayos at mahigpit na ipinatutupad.)*	7 (46.66%)	8 (53.33%)	0 (0%)	0 (0%)	0 (0%)	**4.47**	**Strongly Agree**
6.	Equipment should be regularly checked and maintained. *(Ang mga kagamitan ay dapat na regular na sinusuri at inaayos.)*	8 (53.33%)	7 (46.66%)	0 (0%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
7.	Safety training should be provided to users of the laboratory. *(Dapat magbigay ng pagsasanay sa kaligtasan para sa mga gumagamit ng laboratoryo.)*	9 (60%)	6 (40%)	0 (0%)	0 (0%)	0 (0%)	**4.60**	**Strongly Agree**
8.	Laboratory rules should be strictly monitored and enforced to avoid accidents. *(Ang mga tuntunin sa laboratoryo ay dapat mahigpit na binabantayan at ipinatutupad upang maiwasan ang aksidente.)*	5 (33.33%)	8 (53.33%)	1 (6.67%)	0 (0%)	1 (6.67%)	**4.07**	**Agree**
9.	Clearer instructions should be given before experiments for the safety of all laboratory users. *(Mas malinaw na mga tagubilin ang dapat ibigay bago magsagawa ng eksperimento para sa kaligtasan ng lahat ng gumagamit ng laboratoryo.)*	8 (53.33%)	7 (46.66%)	0 (0%)	0 (0%)	0 (0%)	**4.53**	**Strongly Agree**
10.	Additional safety training and safety drills (e.g., Fire drills) should be practiced and conducted regularly for teachers and students. *(Karagdagang pagsasanay sa kaligtasan at mga drill (hal. fire drill) ay dapat isagawa at regular na ipraktis para sa mga guro at mag-aaral.)*	7 (46.66%)	8 (53.33%)	0 (0%)	0 (0%)	0 (0%)	**4.47**	**Strongly Agree**
Recommended Improvements to Enhance Laboratory Safety in School							**4.45**	**Strongly Agree**

The results of the study from the last table focused on identifying key areas in laboratory safety that require improvement; determining appropriate safety measures that can strengthen existing laboratory practices; recommending improvements in the availability and accessibility of safety equipment and facilities; proposing strategies for strengthening the implementation and enforcement of laboratory safety rules; suggesting enhancements in safety training, orientation, and emergency preparedness; and developing practical recommendations based on the findings of the study. Overall, the findings provide a basis for improving laboratory safety practices and ensuring a safer learning environment.

The data indicate that respondents strongly support the implementation of various improvements to enhance laboratory safety, as reflected by the overall mean of 4.45,

interpreted as "Strongly Agree." This suggests a high level of consensus that additional and strengthened safety measures are necessary to further minimize laboratory hazards.

Among the proposed improvements, *"Safety training should be provided to users of the laboratory"* obtained the highest mean of 4.60 (Strongly Agree), indicating that respondents consider training as the most essential factor in improving laboratory safety. This highlights the importance of equipping both students and teachers with adequate knowledge and skills to handle potential hazards.

Several indicators also received high ratings of 4.53 (Strongly Agree), including the availability of safety equipment and emergency contact information, posting of laboratory layout for emergency movement, regular equipment checking and maintenance, and providing clearer instructions before experiments. These findings emphasize that preparedness, accessibility of resources, and clear communication are key areas for improvement.

Other indicators, such as *proper chemical labeling and storage* (4.40), *strict enforcement of PPE use* (4.47), and *regular safety drills and additional training* (4.47), were also rated Strongly Agree, indicating strong support for reinforcing both preventive and protective measures in laboratory settings.

Meanwhile, *"Laboratory rules should be strictly monitored and enforced"* received a slightly lower mean of 4.07 (Agree). Although still positive, this suggests that while respondents recognize its importance, there may be minor inconsistencies in enforcement or varying perceptions regarding how strictly rules are currently implemented.

Notably, almost all items received no responses under the disagree categories, indicating a high level of agreement and shared perception among respondents regarding the necessity of these improvements.

Overall, the findings imply that respondents are highly aware of the need to strengthen laboratory safety through comprehensive approaches, including training, proper equipment, clear procedures, regular maintenance, and strict policy implementation. These recommended improvements, if consistently applied, can significantly enhance the safety and effectiveness of school laboratory environments.

Focus Group Discussion

Research Problem 1: What types of laboratory hazards are present in school laboratories?

1. What types of hazards have you observed in your school laboratory?

Anu-anong uri ng panganib ang iyong napansin sa laboratoryo ng inyong paaralan?

The participants reported that their practical work activities created the most dangerous situations they faced during their program. Students in cookery, bread and pastry, and other technical subjects identified three main dangers, which included burns from hot equipment and cuts from sharp tools, and slips that occurred on wet or oily floors. The participants stated that laboratory work exposed them to harmful effects, which included cleaning agents and all chemicals used during their cleaning activities. Some teachers pointed out that improper handling of electrical equipment, such as ovens or mixers, may also pose a risk if not carefully monitored. The observations show that both students and teachers have knowledge about the various hazards that exist in their workplace.

2. Can you describe any accident or near-miss incident that happened in the laboratory?

Maaari mo bang ilarawan ang anumang aksidente o muntik nang aksidente na nangyari sa laboratoryo?

One student experienced an oven accident when he tried to take out a tray without using the proper method. Teachers also noted that beginners often experience minor knife cuts, which require immediate treatment. The situation demonstrates that incidents happen through protected systems which that allow for immediate emergency response.

Research Problem 2: What safety interventions are currently implemented to address these hazards?

1. What safety practices or interventions are currently being followed in your school laboratory, and how are they applied during actual laboratory activities?

Ano-ano ang mga safety practices o hakbang sa kaligtasan na kasalukuyang sinusunod sa inyong school laboratory, at paano ito isinasagawa sa aktwal na laboratory activities?

TVL teachers explained that safety is introduced at the start of every activity through clear instructions and demonstrations. The students receive reminders for appropriate tool and equipment usage before they start their work. Most activities require the use of personal protective equipment which includes aprons, gloves, and hairnets. The teachers make sure safety reminders stay visible throughout the work area. Students know about the existence of fire extinguishers and basic emergency materials which are kept in their locations. The teachers monitor students during the activity to ensure they follow safety practices.

2. Based on your experience, which safety interventions are consistently implemented, and which ones are sometimes ignored or not practiced? Why do you think this happens?

Batay sa inyong karanasan, alin sa mga safety interventions ang palaging naipapatupad, at alin naman ang minsan ay hindi nasusunod o napapabayaan? Sa inyong palagay, bakit ito nangyayari?

The participants confirmed that both safety briefings and teacher supervision are implemented at all times. The students should use personal protective equipment, yet this requirement does not receive full compliance from all students. Some people reported that equipment sharing occurs at certain times, which creates obstacles for complete compliance. Students tend to overlook their responsibility to organize and store tools after they finish using them because they want to finish their work. Teachers identified time

pressure and resource limitations, together with student complacency, as the reasons why students fail to follow required procedures.

Research Problem 3: The effectiveness of safety interventions shows their ability to reduce laboratory hazards through their protective functions.

1. In what ways have safety interventions helped reduce laboratory hazards?

Sa anong paraan nakatulong ang mga safety interventions sa pagbawas ng panganib sa laboratoryo?

The safety measures that the school implemented have been successful, according to both students and teachers who attended the school. The students learn to control their behavior through regular reminders, which show them proper conduct. Protective equipment effectively decreases the risk of injuries which occurs during activities that use sharp tools and produce high temperatures. The teachers use their supervision power to stop dangerous behavior through instant correction methods.

2. Can you share specific experiences where safety measures prevented an accident?

Maaari ka bang magbahagi ng karanasan kung saan napigilan ng safety measures ang isang aksidente?

A student reported that using an apron together with glove protection equipment prevented his facial burns during his work with heated materials. The other student explained that when a teacher reminded him to shut down the equipment, it successfully stopped a potential electrical safety threat. The teachers explained that their ongoing monitoring work enables them to stop students from making minor mistakes, which would later develop into major problems. The evidence demonstrates that safety procedures have been successfully implemented and they effectively protect people from danger.

Research Problem 4: What improvements can be recommended to enhance laboratory safety in schools?

1. What would you recommend to enhance laboratory safety?

Ano ang mairerekomenda mo upang mapahusay ang kaligtasan sa laboratoryo?

The participants who took part in the study believed that safety training should be conducted more frequently because it would help students learn proper safety procedures better, especially for students who are still developing their skills. The group proposed that students should have better access to personal protective equipment because it would help them meet safety requirements during their school activities. The laboratory needs better visual guides and laboratory operational rules to help students understand their work better. Teachers pointed out that equipment should be handled through regular maintenance procedures, and emergency practice sessions should be conducted to ensure readiness for unexpected situations.

2. What challenges do you face in following laboratory safety rules?

Anong mga hamon ang iyong kinakaharap sa pagsunod sa mga tuntunin sa kaligtasan ng laboratoryo?

The most common challenge that participants reported was that students need better access to materials and equipment because their current resources limit their ability to practice safety procedures. The time limits that students encounter during their practical work activities create problems because they need to finish their work within the designated time period. The teachers in the classroom observed that they face challenges when they try to enforce discipline for all students in their bigger classrooms.

Observation Checklist

Types of Laboratory Hazards Present *(Mga Uri ng Panganib sa Laboratoryo)*			
No.	**Statement**	**Yes**	**No**
1	Physical hazards (e.g., broken tools, slippery floors) are present in the laboratory. *May mga pisikal na panganib (hal. sirang kagamitan, madulas na sahig) sa laboratoryo.*	☐	☐
2	Chemical hazards (e.g., improper handling or storage of chemicals) are evident. *May mga panganib na kemikal (hal. maling paghawak o pag-iimbak ng kemikal).*	☐	☐
3	Electrical hazards (e.g., exposed wires, overloaded outlets) are observed. *May mga panganib na elektrikal (hal. exposed wires, overloaded na saksakan).*	☐	☐
4	Fire hazards (e.g., flammable materials, unsafe equipment use) are present. *May mga panganib sa sunog (hal. madaling magliyab na materyales, maling paggamit ng kagamitan).*	☐	☐
5	Biological hazards are present and identifiable. *May mga biyolohikal na panganib at ito ay natutukoy.*	☐	☐
Safety Interventions Currently Implemented *(Mga Hakbang sa Kaligtasan na Ipinapatupad)*			
6	Safety orientation is conducted before laboratory activities. *May safety orientation bago ang laboratory activities.*	☐	☐
7	Personal Protective Equipment (PPE) is available and used by students. *May PPE at ginagamit ito ng mga mag-aaral.*	☐	☐
8	Safety signs and reminders are clearly visible in the laboratory. *May malinaw na safety signs at paalala sa laboratoryo.*	☐	☐
9	Fire extinguishers are available and accessible when needed. *May fire extinguisher na madaling ma-access kung kinakailangan.*	☐	☐
10	First aid kits and emergency materials are available in the laboratory. *May first aid kit at iba pang kagamitang pang-emergency sa laboratoryo.*	☐	☐
Effectiveness of Safety Interventions *(Bisa ng mga Hakbang sa Kaligtasan)*			
11	Safety interventions help reduce the occurrence of laboratory accidents. *Nakatutulong ang safety interventions sa pagbawas ng aksidente sa laboratoryo.*	☐	☐
12	Students consistently follow safety rules during laboratory activities. *Palaging sinusunod ng mga mag-aaral ang safety rules sa laboratoryo.*	☐	☐
13	Teachers actively monitor and enforce safety practices.	☐	☐

	Aktibong binabantayan at ipinapatupad ng guro ang safety practices.		
14	The use of PPE effectively protects students from hazards. *Epektibong napoprotektahan ng PPE ang mga mag-aaral mula sa panganib.*	☐	☐
15	Safety reminders and instructions are clearly understood and followed. *Naiintindihan at sinusunod ang mga paalala at instruksyon sa kaligtasan.*	☐	☐
Recommended Improvements for Laboratory Safety *(Mga Inirerekomendang Pagpapabuti sa Kaligtasan ng Laboratoryo)*			
16	Additional safety training is needed for students and teachers. *Kailangan ng dagdag na safety training para sa guro at mag-aaral.*	☐	☐
17	More PPE and safety equipment are needed in the laboratory. *Kailangan ng dagdag na PPE at kagamitan sa laboratoryo*.	☐	☐
18	Laboratory safety procedures and layout should be clearly posted. *Dapat malinaw na nakapaskil ang safety procedures at layout ng laboratoryo.*	☐	☐
19	Regular maintenance of laboratory tools and equipment is needed. *Kailangan ng regular na maintenance ng mga kagamitan sa laboratoryo.*	☐	☐
20	Regular safety drills should be conducted in the laboratory. *Dapat magsagawa ng regular na safety drills sa laboratoryo.*	☐	☐

The observation showed that all of the major types of hazards were present in the lab, since they were all marked with a YES. There were physical dangers during activities, like floors that were slippery floors and equipment that didn't work right. There were also signs of chemical dangers, especially when it came to how to store and handle things. People were worried about electricity, like using more than one device, and there were also fire risks because of the equipment that generates heat. There were also biological risks in some cases, depending on what was going on.

Most safety measures were seen and marked as YES, especially safety orientation, fire extinguishers, and safety signs that were easy to see. It was clear that fire extinguishers were always available and easy to get to, which showed that they were being used consistently. Teachers were also seen reminding students to be safe before activities, and safety orientations were held on a regular basis. But some things were not always observed in the same way. Most of the time, students wore PPE, but there were times when not all of them had the right gear. First aid kits were also available, but they weren't always fully stocked or easy to get to. Some areas did a good job of labeling and storing chemicals, but this wasn't always the case for all materials.

The observation also indicates that safety interventions are predominantly effective, as evidenced by the majority of indicators being marked as YES. It was clear that students were following safety rules and that teachers were keeping an eye on what was going on in the lab. Using PPE, when it was available, made tasks safer to do. There were also safety reminders posted in the lab that were easy to see and seemed to help students behave. Even so, there were times when compliance was different, especially when students were trying to get things done. This means that safety measures are in place and work, but they may not always be used in the same way depending on the situation.

On the last part of the observation checklist, there is a clear need for more PPE, better organization of lab materials, and more consistent access to safety gear. It was also noted that some areas didn't have clear signs showing where the labs were and how to get to them in case of an emergency. It was decided that tools and equipment needed to be regularly maintained because some of them were showing signs of wear. The absence of observable safety drill practices indicates a domain necessitating additional scrutiny.

The observation checklist results confirm that the laboratory maintains a generally safe and functional environment, supported by existing safety practices and awareness among users. However, certain areas, particularly resource availability, equipment maintenance, and uniform implementation of safety procedures, require further attention.

Summary of Findings

The study entitled *"Evaluative Study of Laboratory Hazards and Safety Interventions in School"* revealed the following key findings:

1. Types of Laboratory Hazards Present in School Laboratories

The respondents showed a very high level of awareness of laboratory hazards, with an overall mean of 4.41 (Strongly Agree). This indicates that laboratory hazards such as physical, chemical, biological, electrical, and fire risks are clearly recognized by students and teachers. Among these, the importance of safety signs and emergency equipment obtained the highest mean of 4.73, showing strong agreement that preventive safety measures are essential in avoiding accidents. Proper housekeeping and safety training were also highly rated, both with a mean of 4.60, indicating strong recognition of their role in ensuring laboratory safety.

2. Safety Interventions Currently Implemented in School Laboratories

The findings revealed that safety interventions are generally well implemented, with an overall mean of 4.21 (Strongly Agree). The most commonly implemented safety measure is the availability of fire extinguishers, with a mean of 4.60, indicating strong preparedness for emergencies. Safety orientation before laboratory activities (4.47) and enforcement of PPE use (4.40) were also highly rated. However, lower ratings were observed in the availability of PPE (3.93), presence of first aid kits (4.00), and proper labeling and storage of chemicals (4.07), suggesting inconsistencies in some safety resources and practices.

3. Effectiveness of Safety Interventions in Reducing Laboratory Hazards

The results showed that safety interventions are perceived to be effective, with an overall mean of 3.81 (Agree**)**. Respondents strongly agreed that PPE use, safety training, safety reminders, and safety inspections help reduce hazards and prevent accidents, with several items obtaining a mean of 4.60. However, some respondents expressed neutral responses to negatively stated items, indicating slight uncertainty or inconsistency in the perceived effectiveness

of some safety practices.

4. Recommended Improvements to Enhance Laboratory Safety

The respondents strongly agreed on the need for further improvements, with an overall mean of 4.45 (Strongly Agree). The highest-rated recommendation was the provision of regular safety training for laboratory users (4.60). Other highly supported improvements include ensuring availability of safety equipment (4.53), proper laboratory layout posting (4.53), regular equipment maintenance (4.53), strict enforcement of PPE use (4.47), and conducting regular safety drills (4.47). These findings indicate a strong demand for strengthening laboratory safety systems and practices.

Conclusion

Based on the findings of the study entitled *"Evaluative Study of Laboratory Hazards and Safety Interventions in School,"* it can be concluded that school laboratories present a variety of potential hazards, including physical, chemical, biological, electrical, and fire-related risks. The respondents demonstrated a high level of awareness regarding these hazards, as reflected in the overall mean of 4.41, interpreted as *Strongly Agree*. This indicates that both students and teachers clearly recognize that laboratory environments pose significant risks when safety measures are not properly observed.

In terms of safety interventions, the study revealed that various safety measures are already implemented in school laboratories, such as safety orientation, use of personal protective equipment (PPE), availability of emergency equipment, and posting of safety rules. These interventions were rated positively with an overall mean of 4.21 (*Strongly Agree*), indicating that respondents perceive safety practices to be generally in place and actively implemented.

Furthermore, the study found that safety interventions are considered effective in reducing laboratory hazards, with an overall mean of 3.81 (*Agree*). This suggests that respondents believe safety measures such as PPE use, safety training, inspections, and reminders contribute significantly to preventing accidents and minimizing risks, although some variability in responses indicates that effectiveness is not yet consistently experienced by all users.

Finally, the study revealed strong support for further improvements in laboratory safety, with an overall mean of 4.45 (*Strongly Agree*). Respondents emphasized the need for continuous safety training, improved availability of equipment, stricter enforcement of rules, proper labeling and storage of chemicals, and regular maintenance and safety drills. This indicates that while current safety systems are functional, there is still a need to strengthen and standardize their implementation to ensure a safer laboratory environment.

Overall, the study concludes that school laboratories have established safety interventions that are generally effective and positively perceived; however, inconsistencies in implementation and resource availability highlight the need for continuous improvement to fully ensure safety and hazard prevention.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are hereby proposed to enhance laboratory safety in school settings:

1. Strengthen Continuous Safety Training

Regular and structured safety training should be conducted for both students and teachers to enhance awareness, improve hazard recognition, and develop proper laboratory practices.

2. Improve Availability and Accessibility of Safety Equipment

Schools should ensure that essential safety equipment, such as PPE, first aid kits, fire extinguishers, eye wash stations, and emergency contact information, is complete, functional, and easily accessible at all times.

3. Enhance Enforcement of Safety Rules and Protocols

Strict monitoring and consistent enforcement of laboratory rules should be implemented to ensure compliance and minimize unsafe practices during laboratory activities.

4. Standardize Laboratory Safety Practices

Schools should establish uniform laboratory safety guidelines to ensure consistent implementation of safety measures across all laboratories.

5. Regular Maintenance and Inspection of Equipment

Laboratory tools and equipment should be routinely inspected, maintained, and repaired to prevent accidents caused by malfunction or misuse.

6. Improve Chemical Management and Labeling Systems

All chemicals and hazardous materials must be properly labeled, safely stored, and systematically organized to reduce risks of exposure and accidents.

7. Conduct Regular Emergency Drills and Preparedness Activities

Fire drills and other emergency simulations should be conducted regularly to prepare students and teachers for real-life laboratory emergencies.

8. Strengthen Safety Communication and Visibility

Safety rules, laboratory layouts, and emergency procedures should be clearly posted and regularly updated to ensure awareness and quick response during emergencies.

9. Promote a Strong Safety Culture in Laboratories

Schools should encourage responsibility, discipline, and awareness among laboratory users to foster a culture of safety and accountability.

10. Future Research Enhancement

Further studies may be conducted with larger sample sizes and across multiple schools to obtain more comprehensive data and validate the findings of this study.

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