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Research Article (Araştırma Makalesi)

Risk Assessment in the Workshops of the Uşak Turkey Chambers and Exchanges Union Vocational and Technical Anatolian High School Electricity Department

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Abstract

This study aims to identify potential dangers in a vocational high school electrical workshop, conduct a comprehensive evaluation, and assess the requisite preventive measures. A risk analysis was conducted in accordance with national and international regulations, including the equipment utilized in the workplace environment, the prevailing occupational safety practices, and the employees' degree of expertise. The analysis discussed in detail risk elements such as electric shock, fire, short circuit, overload, and mechanical injuries. For each risk factor, comprehensive evaluations were made based on the identified hazards, risk assessment methods, and measurement results; within this scope strategic recommendations were developed to minimize risks. The findings reveal shortcomings in the current risk management practices and emphasize the importance of training workshop personnel and implementing continuous inspection mechanisms to ensure a safe working environment As a result of the study, among 57 risky situations, 3 were found to be very high risk, 24 high risk, 25 medium risk, and 5 low risk. The study aims to contribute to minimizing risks and preventing workplace accidents by offering recommendations for corrective measures that can be applied in vocational high school electrical workshops.

Anahtar Kelimeler: *Electrical workshop, Occupational health and safety, Risk assessment, Vocational and technical high school.*

Uşak Türkiye Odalar ve Borsalar Birliği Mesleki ve Teknik Anadolu Lisesi Elektrik Bölümü Atölyelerinde Risk Değerlendirmesi

Özet

Bu çalışma, mesleki ve teknik lise elektrik atölyesinde potansiyel tehlikeleri belirlemeyi, kapsamlı bir değerlendirme yapmayı ve gerekli önleyici tedbirleri incelemeyi amaçlamaktadır. Risk analizi, işyeri ortamında kullanılan ekipmanlar, mevcut iş güvenliği uygulamaları ve çalışanların uzmanlık düzeyi dikkate alınarak ulusal ve uluslararası düzenlemelere uygun şekilde gerçekleştirilmiştir. Analizde elektrik çarpması, yangın, kısa devre, aşırı yüklenme ve mekanik yaralanmalar gibi risk unsurları ayrıntılı olarak ele

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alınmıştır. Her risk faktörü için belirlenen tehlikeler, risk değerlendirme yöntemleri ve ölçüm sonuçları temelinde kapsamlı değerlendirmeler yapılmış; bu doğrultuda riskleri en aza indirmek için stratejik öneriler geliştirilmiştir. Bulgular, mevcut risk yönetimi uygulamalarındaki eksiklikleri ortaya koymakta ve atölye personelinin eğitiminin yanı sıra sürekli denetim mekanizmalarının uygulanmasının güvenli bir çalışma ortamı sağlamak açısından önemini vurgulamaktadır. Çalışma sonucunda, tespit edilen 57 riskli durumdan 3'ünün çok yüksek riskli, 24'ünün yüksek riskli, 25'inin orta riskli ve 5'inin düşük riskli olduğu belirlenmiştir. Bu çalışma, meslek liselerindeki elektrik atölyelerinde risklerin en aza indirilmesine ve iş kazalarının önlenmesine katkı sağlamak amacıyla uygulanabilir düzeltici önlemler için öneriler sunmayı hedeflemektedirAdditionally, it is seen that the m_1 - maximality definition is equivalent to the maximality definition defined for vectors. Strong minimality for m_1 order is also studied and a sufficient condition is proved. Finally, geometric examples are given to show the differences in the definitions given and the applications of the obtained properties.

Keywords: *Elektrik atölyesi, iş sağlığı ve güvenliği, mesleki ve teknik lise, risk değerlendirmesi*

1. Introduction

Work-related accidents and occupational diseases pose serious threats to employee health and lead to significant economic and social losses. Therefore, occupational health and safety has become a priority issue across all sectors. In Türkiye, the primary legal regulation concerning occupational health and safety is Law No. 6331 on Occupational Health and Safety, which adopts a preventive approach aimed at safeguarding employee health and safety. The law defines occupational health and safety as "a set of systematic and scientific measures to be taken in workplaces to protect employees against occupational accidents and diseases." It emphasizes the identification of existing or potential hazards, the assessment and grading of risks arising from these hazards, and the determination of preventive measures [1]. Within this legal framework, employers are obligated to take necessary precautions against risks that may endanger employee health and safety. In addition, employee participation in the process is encouraged to promote a strong safety culture in the workplace.

Vocational and technical high schools are institutions designed to equip students with the knowledge, skills, and competencies required for specific occupational fields. The educational process in these institutions integrates theoretical knowledge with practical applications through a hands-on learning approach. Students are trained in workshops and laboratories, which simulate real workplace conditions and expose them to similar occupational risks. Therefore, the integration of occupational health and safety principles into the educational process is not only a legal obligation but also a fundamental necessity for protecting the physical and psychological well-being of both students and teachers. According to Law No. 6331 on Occupational Health and Safety, it is essential to identify risks in advance, take necessary preventive measures, and establish safe working environments in all workplaces, including educational institutions [1]. Furthermore, equipping students with a strong occupational health and safety culture during their education facilitates their future compliance with safety regulations in professional life [2]. In this context, the systematic incorporation of occupational health and safety practices in vocational high schools plays a critical role in ensuring a sustainable educational environment and fostering a culture of safe schools.

In vocational and technical education institutions, the practical training process is largely conducted in workshop and laboratory environments. These areas enable students to apply theoretical knowledge in practice and develop their professional skills. The use of

industrial machinery, hand tools, electrical equipment, sharp instruments, and chemical substances in these settings enhances the effectiveness of education; however, it also introduces numerous physical, chemical, and ergonomic risks. Therefore, occupational health and safety measures must be implemented meticulously, and potential hazards must be systematically controlled during educational activities conducted in such environments. The preventive measures to be taken in these applied learning spaces are of critical importance for protecting the health of both students and teachers [3].

There are various risk factors in workshop environments that pose threats to the health and safety of workers. These risks are generally classified under five main categories:[4].

- Physical Risks
- Chemical Risks
- Biological Risks
- Electrical Risks
- Ergonomic Hazards

Physical Risks : It refers to the physical factors present in the working environment that may adversely affect the health of employees. These factors generally include noise, vibration, lighting, thermal comfort conditions, radiation, and pressure variations. For example, noise is defined as unwanted and disturbing sounds, and prolonged exposure may lead to health problems such as hearing loss. Similarly, insufficient lighting can reduce the visual performance of employees and cause accidents. Therefore, identifying and controlling physical risk factors in the workplace is of great importance for the protection of employees' health [5].

Chemical Risks: It refers to chemical substances present in the working environment that may adversely affect the health of employees. These factors generally include toxic, corrosive, allergenic, carcinogenic, mutagenic, and reproductive toxic substances. For example, toxic substances may enter the body through inhalation, ingestion, or skin contact, leading to acute or chronic health problems. Similarly, corrosive substances can cause tissue damage when they come into contact with living tissues. Therefore, identifying and controlling chemical risk factors in workplaces is of great importance for protecting employees' health[6]

Biological Risks : They are hazards arising from microorganisms (such as bacteria, viruses, fungi, and parasites), toxins, or other biologically derived substances that may have adverse effects on human health. Exposure to biological agents may result in infections, allergic reactions, or toxic effects [7]. Therefore, the identification, evaluation, and control of biological risks are critically important within the scope of occupational health and safety practices.

Electrical Risks: Electrical hazards are among the most critical safety concerns in workplaces, especially in environments where machinery and powered equipment are heavily used. Electrical risks may arise from contact with live wires, improper grounding, overloaded circuits, or defective equipment. Such conditions can lead to electric shocks, burns, arc flashes, fires, or even fatalities if not properly managed. emphasizes the importance of regular inspections, use of protective equipment, and employee training to prevent electrical incidents. Ensuring compliance with safety standards and implementing risk control strategies are vital for maintaining a safe working environment [8]

Ergonomic Hazards: They arise from physical factors such as repetitive motions, improper postures, excessive force, vibration, prolonged standing, or working in front of a screen, all of which threaten the health and safety of employees. These risks can lead to musculoskeletal disorders, reduced productivity, and, in the long term, workforce loss [9]. Identifying ergonomic hazards and ensuring appropriate working conditions are of great importance in terms of occupational health and safety.

Incidents in workshop settings arise from the intersection of the previously listed risk variables. The subsequent examples exemplify several of these occurrences:

- In 2007, a worker was using a Bosch Rotozip tool to cut drywall on the ceiling of a residential construction site. The tool's cord had an inadequate splice and was connected to an extension cord, which itself was linked through a power strip and three additional extension cords to an outlet in an adjacent building. The extension cords lacked grounding pins. While operating the tool, the worker had wrapped the cord around his neck. A witness heard the worker scream and saw him throw the tool. The worker collapsed and lost consciousness. Although he was taken to the hospital, he could not be resuscitated. The electric shock did not leave burn marks on the body but caused fatal cardiac arrhythmia[10].

-Inadequate ventilation and the absence of personal protective equipment during soldering operations resulted in the intake of fumes, leading to respiratory issues and headaches among pupils.

-During maintenance on an electrical panel in a high school workshop, a student accidentally made contact with both the phase and neutral terminals using a metal screwdriver, which resulted in a short circuit. The arc and electric current caused second-degree burns on the student's right hand. Following the incident, it was determined that the panel had not been fully de-energized and that personal protective equipment (e.g., insulated gloves) was not used. It was emphasized that such accidents can be prevented by implementing proper energy isolation procedures and lockout/tagout (LOTO) systems [11].

-On January 2, 2014, during a chemistry demonstration at Beacon High School in New York City, methanol vapor ignited during a flame test commonly referred to as the "Rainbow Experiment," resulting in injuries to two students. This incident, along with similar accidents caused by such demonstrations, underscores the critical importance of adhering to strict safety protocols in educational institutions [12].

-A study conducted at the Faculty of Engineering and Technology, Mehran University, examined the ergonomic challenges faced by students during lectures, laboratory sessions, and workshop activities. Using the Rapid Upper Limb Assessment (RULA) method, it was determined that students' working postures in computer labs, mechanical workshops, and other laboratory environments posed significant health risks. In particular, students reported pain in the back, neck, and shoulder regions due to prolonged and improper postures. These findings highlight the importance of ergonomic interventions in university settings [13].

Considering all these risk factors, the work area of the Vocational and Technical Anatolian High School Electricity-Electronics Department, along with the Uşak Turkey Chambers and Exchanges Union, was chosen for this study. A risk analysis was performed utilizing the

5x5 L-type matrix method for eight workshops and laboratories. Preventive measures to mitigate present risk levels were identified and executed based on the analysis results.

2. Experimental Section

The L-type matrix is a quantitative research methodology utilized to assess cause-and-effect correlations. This method is the most favored risk analysis approach in the occupational health and safety sector due to its simplicity and the capability for execution by a single individual. This strategy involves analyzing the probability of an event and its subsequent effects as a binary variable. The risk score is calculated by multiplying the chance by the severity level and recorded accordingly in the table. The values between 1-5 are given for probability and

Risk Score = Probability x Intensity

severity values (Table1 and Table2). The risk score is calculated by multiplying the probability and severity values. A risk score below 8 indicates an acceptable amount of risk. If the risk score is 8 or greater and less than 15, it is classified as medium risk. If the risk score is 15 or less than 20, it is classified as high risk; if the risk score exceeds 20, it is deemed to be at an unacceptable risk level. If the risk is at its maximum level, the study is halted and cannot be initiated without implementing measures[14].

Table 1. 5x5 L-Type Matrix method intensity assessment table [14]

Level	Intensity	Score
Insignificant	No Loss of Working Hours – First Aid Only	1
Minor	No loss of working days – First Aid or medical treatment	2
Moderate	Accident with working day loss - minor injury	3
Major	Limb Loss, Severe Injury - Long-Term Treatment	4
Catastrophic	Death, Environmental Disaster	5

Table 2. 5x5 L-Type Matrix method probability assessment table [14]

Level	Probability	Score
Very low	Rare (Once a year)	1
Low	Unlikely (Several Times a Year)	2
Medium	Possible (Once a month)	3
High	Likely (Once a week)	4
Very high	Almost certain (Everyday)	5

Table 3. 5x5 L-Type Matrix method risk assessment table [14]

Level/ Intensity	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very low 1	NEGLIGIBLE 1	LOW 2	LOW 3	LOW 4	LOW 5
Low 2	LOW 2	LOW 4	LOW 6	MEDIUM 8	MEDIUM 10
Medium 3	LOW 3	LOW 6	MEDIUM 9	MEDIUM 12	HIGH 15
High 4	LOW 4	MEDIUM 8	MEDIUM 12	HIGH 16	HIGH 20

Very high 5	LOW 5	MEDIUM 10	HIGH 15	HIGH 20	EXTREME (Unacceptable) 25

Explanations of the risk scores are given below;

1 Point: Regarded as insignificant. They are negligible dangers that are of little significance.

2-6 Points: Deemed acceptable. This is a manageable risk group that necessitates long-term attention. Nonetheless, current controls must be preserved and subjected to verification.

8-12 Points: Classified as intermediate level. These are the significant dangers that necessitate precautionary measures in the short term. Measures must be implemented to mitigate the identified risks.

15-20 Points: Regarded as significant. This risk category is critically significant and necessitates prompt intervention.

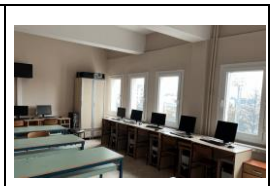
25 Points: Deemed Intolerable. It is a risk group in which employment initiation is not permitted without implementing measures.

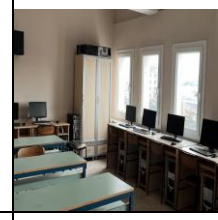
3. Results and Discussion

The risk analysis data derived from the assessment of the workshops at the Uşak Turkey Chambers and Exchanges Union Vocational and Technical Anatolian High School Electricity Department is displayed in Table 4. Although the eight workshops and laboratories examined differ from each other, the eight risk analysis tables prepared for this study have been consolidated into a single table due to many common risks. The hazards and risks identified through testing and observations have been analyzed in conjunction with analogous studies, and this table delineates the requisite safety measures.

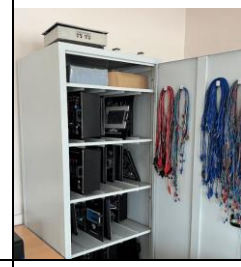
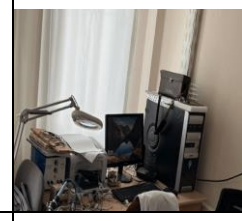
Table 4. Table of Risk Assessment

Score	Unit	Hazard	Hazard Source	Risk	Exposure/ Affected	Assessment Of Risk				Precautions To Be Taken To Maintain An Acceptable Level	Photo
						P	I	Risk Score			
						Probability (1-5)	Intensity (1-5)	Risk = P X I	Importance Level		

1	**EETW**	Fire	Lack of fire extinguishers	Early intervention may be postponed due to a potential fire threat.	Teacher and students	**4**	**5**	**20**	**High**	Fire extinguishers must be positioned within the laboratory, and signage describing their positions should be displayed.	
2	**EETW**	Electricity	Insufficient insulating mats appropriate for current in front of electrical panels	Risk of exposure to electric current, electric shock, injury, and fatality due to electrical leakage.	Teacher and students	**4**	**5**	**20**	**High**	An insulating mat must be positioned in front of the electrical panels.	
3	**EETW**	Electricity	The front of the panel is occupied. Dispersed fecal matter observed in the laboratory at the junctions between benches.	Electric shock, fire hazard, postponement of prompt assistance	Teacher and students	**4**	**5**	**20**	**High**	The front of the laboratory's electrical panels must remain unobstructed up to the ceiling. The extension of the bench beneath the Electrical Panel must be removed, and an insulating mat should be installed on the floor.	
4	**EETW**	Irregularity of crossing paths	Scattered leaving of stools in the lab in the transitions between benches.	It may result in tripping and falls during passage, electric shock, fire hazards, and delays in early intervention.	Teacher and students	**3**	**2**	**9**	**Medium**	Following the laboratory sessions, surplus stools may be gathered in an unoccupied location. Consequently, superfluous space is not utilized.	
5	**EETW**	Lack of local ventilation	Lack of local ventilation to immediately remove poisonous and toxic gases from the interaction of chemicals used.	Respiratory irritation, poisoning.	Teacher and students	**3**	**3**	**9**	**Medium**	A local ventilation system must be constructed in the designated area of the laboratory.	

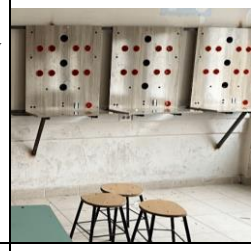
6	**EETW**	Computer usage	Computers located on high workbenches	Ergonomic posture disorders, physical discomfort	Teacher and students	**3**	**3**	**9**	**Medium**	Separate work desks and ergonomic chairs should be provided for computers	
7	**EETW**	Electricity	Malfunction of electrical/measurement instruments (Calibration error)	Incorrect measurement and electric shock	Teacher and students	**4**	**5**	**20**	**High**	Work according to instructions and perform regular inspections	
8	**EETW**	Electricity	Distraction by others (horseplay)	Various accidents and injuries	Teacher and students	**4**	**5**	**20**	**High**	Evacuate the area during work and establish strict rules to prevent interference with the worker	
9	**EETW**	Electricity	Internal distribution board without leakage current relay	Absence of a leakage current relay in the board leading to electric shock	Teacher and students	**3**	**5**	**15**	**High**	Leakage current relays should be installed in main and subsidiary panels according to the selectivity principle	
10	**EETW**	Electricity	Exposure to voltage due to lack of grounding	Contact with electricity, with burns due to arc	Teacher and students	**5**	**5**	**25**	**Extreme**	Work according to instructions and perform regular inspections	
11	**EETW**	Electricity	Weak connection/lack of railings on mobile ladder	Falling, injury	Teacher and students	**3**	**5**	**15**	**High**	The mobile ladder should be made safe	
12	**EETW**	Electricity	Incorrect cable selection, inappropriate cable cross-section	Arc, fire	Teacher and students	**4**	**5**	**20**	**High**	Cables with an appropriate cross-section should be used and training should be provided	

13	**EETW**	Improper use of hand	Electric shock, short circuit, cuts	Burns, injuries, electric shock, death	Teacher and students	**4**	**5**	**20**	**High**	Periodic inspections of tools, use of insulated materials, and proper supervision should be ensured	
14	**EETW**	Failure to provide adequate ventilation	Inhalation of dust and fumes from chemicals utilized in the workshop and laboratory.	In case of inhalation of the dusts in the workshop and laboratory and odors from the chemicals used, various health problems may occur.	Teacher and students	**3**	**3**	**9**	**Medium**	It is essential to eliminate detrimental dust and chemicals from the workshop and laboratory by consistently ventilating the workspace at regular intervals.	
15	**EETW**	First aid supplies	Expiration date of the materials in the first aid cabinet, hindering intervention in the event of damage or improper use of expired materials.	Infection risk, "incorrect intervention	Teacher and students	**3**	**4**	**12**	**Medium**	The supplies in the first aid cabinet must be replenished and inspected at regular intervals to avert a recurrence of such a catastrophe..	
16	**EETW**	Lack of warning	Lack of warning indicators for personal protective equipment utilized in the laboratory.	Accidental injuries	Teacher and students	**3**	**3**	**9**	**Medium**	Warning signs for each P.P.E. should be prominently displayed to ensure visibility throughout the laboratory..	
17	**EETW**	Mislabeling of chemicals	Changing the inscription on the thinner, Hydrogen Peroxide, bottle by not methanol.	Accident, injury	Teacher and students	**3**	**4**	**12**	**Medium**	Chemical bottles should not be interchanged. Labels containing distinct warning symbols for each chemical must be affixed, and caution should be exercised to avoid adhering handwritten paper to bottles. Inappropriate utilization of chemicals may result in misunderstandings and incidents.	

18	EETW	Unlabeled	Lack of labels on the date of preparation of their solutions and what their content is.	Chemical exposure	Teacher and students	3	2	6	Low	After the studies, labels indicating the production date and contents should be affixed to the products.	
19	EETW	Dropping material from	The shelves are narrow and there is no elevation at the ends to prevent materials from falling.	Chemical exposure, injury	Teacher and students	4	2	8	Medium	Elevations must be implemented to avert materials from cascading over the shelf's sides.	
20	EETW	Putting laboratory devices on	Placing unused devices on the laboratory floor.	Falling, injury, property damage	Teacher and students	3	3	9	Medium	To safeguard both gadgets and students, electronics ought to be housed in cabinets rather than on the ground.	
21	EETW	Possibility of material	Irregular and overlapping of the materials contained in the dish.	Injury	Teacher and students	3	2	6	Low	The dish should not contain more stuff than its capacity allows. Overlapping materials may shift and descend, resulting in injury.	
22	EETW	Heavy Metals	Heavy metal waste box on the counter	Chemical exposure, injury	Teacher and students	3	3	9	Medium	Chemical waste must be disposed of in designated waste bins located within the laboratory. It should not be placed on countertops. Empty chemical bottles must not be left on the floor near the door edges.	
23	EETW	P.P.E.	Leaving P.P.E. irregular in the working environment.	Accident , injury	Teacher and students	3	3	9	Medium	Improperly maintained personal protective equipment may inherently represent a risk due to its diminished protective capabilities. Consequently, personal protective equipment	

										(P.P.E.) must be stored appropriately and maintained with diligence.	
24	**EETW**	Laboratory hygiene	Dirty lab floor.	Chemical exposure, injury, falling	Teacher and students	**3**	**3**	**9**	**Medium**	Laboratories should be cleaned regularly.	
25	**EETW**	Rusty nail, metal	In some parts of the workshop, rusty nails and metal sections can be found	Tetanus, stinging, injury	Teacher and students	**3**	**4**	**12**	**Medium**	Rusty nails should be removed from the workshop and laboratory.	
26	**EETW**	Fire	Absence of fire detectors	Property damage, injury, death.	Teacher and students	**4**	**5**	**20**	**High**	Fire detectors should be installed inside the laboratory. Smoke detectors play an important role in early detection of fire.	
27	**EETW**	Absence of MSDS charts of chemicals	Accidents may happen as a result of students taking the course not knowing the necessary information about the used chemicals	Unconscious use, injuries	Academic stuff and students	**3**	**4**	**12**	**Medium**	MSDS charts are documents created to provide information regarding each chemical. Documents encompass both the characteristics of the chemicals and the disposal techniques in case of an accident, as well as the potential hazards that may occur when combined with other chemicals. The supplier business must provide the MSDS charts for the utilized chemicals, which should be maintained at the laboratory.	

28	EETW	Contact with Hot	Contact with soldering iron, transformer, and electronic component	Various degrees of burns, injuries	Teacher and students	3	3	9	Medium	Protective soldering iron stand should be used, flame-resistant gloves should be used, and regular training should be provided	
29	EETW	Absence of a warning	Slipping, falling	Injury, various fractures in the body, soft tissue damage	Teacher nd students	4	5	20	High	Warning signs should be used, and training sessions should be provided.	
30	EETW	Disposal of	Absence of drain for cleaning water	Chemical residues and slippery floor	Teacher and	3	3	9	Medium	A drainage system should be established in an appropriate area for cleaning the workshop floor.	
31	EETW	Chemical	Failure to use protective equipment during preparation	Inhalation of harmful gases, eye and skin contact	Teacher and	5	3	15	High	Local ventilation should be used and protective equipment (mask, goggles, gloves) should be worn	
32	EETW	Faulty insulation of	Loss of insulation in safety equipment during operation	Various burns, injuries, death	Teacher and students	4	5	20	High	Regular periodic inspections, cleaning, and maintenance of the safety equipment for manual operation should be conducted and labeled (e.g., stanchions, insulated boots, insulated gloves, helmet with visor)	
33	EETW	Slippery or uneven floor	Water spillage, oil, cable clutter	Falling, injuries	Teacher and students	3	3	9	Medium	The floor should be cleaned regularly and non-slip materials should be used	
34	EETW	Flammable or toxic	Incorrect storage, leaving materials exposed	Respiratory diseases, fire	Teacher and students	4	4	16	High	Chemicals should be stored in appropriate cabinets with safety labels	

35	**EETW**	Overloading in the	Use of multiple outlets, old cables	Short circuit and fire	Teacher and students	**4**	**5**	**20**	**High**	Panels should be checked regularly and appropriate fuse systems should be used	
36	**EETW**	Earthquake/Natural	Unstable buildings, collapsed or cracked walls and columns	Various degrees of injury, death	Teacher and students	**4**	**5**	**20**	**High**	Obtain a building earthquake safety report and conduct drills	
37	**EETW**	Ergonomic	Unsuitable working areas Incorrect posture and prolonged work	Musculoskeletal disorders	Teacher and students	**3**	**3**	**9**	**Medium**	Work areas should be arranged ergonomically and training should be provided	
38	**EETW**	Lighting	Non-functional or insufficient lighting	Visual impairment, various degrees, Falling, collision/injury	Teacher and students	**4**	**4**	**16**	**High**	Perform indoor lighting measurements and evaluations according to TS EN12464-1 and measure lighting for night work	
39	**EETW**	Ergonomic	Moving heavy and bulky materials, Manual handling and heavy lifting	Musculoskeletal disorders	Teacher and students	**3**	**3**	**9**	**Medium**	Heavy and bulky materials should be transported using mechanical systems and relevant observation and training should be provided	
40	**EETW**	Psycho-social hazards.	Long working hours, work intensity, workload, etc	Stress, burnout, life imbalance	Teacher and students	**3**	**2**	**6**	**Low**	Psychological evaluation should be conducted by the workplace doctor (or, if available, an industrial psychologist/psychologist) as needed or upon the employee's request, and recorded in the health file	

41	EETW	High noise levels	Excessive noise from machines and devices	Hearing loss, stress, distraction	Teacher and students	3	3	9	Medium	Ear protective equipment should be provided and used	
42	EETW	Non-use or [illegible]	Failure to use PPE regularly	Injuries, health problems	Teacher and students	2	4	8	Medium	PPE use should be encouraged and monitored	
43	EETW	Working conditions	Teachers and Students Working Alone	Not being reached in time. Various health effects	Teacher and students	2	3	6	Low	Investigate personal panic alarm systems and ensure more frequent communication with the technicia	
44	EETW	Machine safety	Entanglement with rotating shafts, snagging, collision	Various injuries – crushing, fractures	Teacher and students	4	5	20	High	Machine inspections should be performed, protective devices installed, and training provided	
45	EETW	Machine safety	Machine falling	Hand, foot, and body injuries	Teacher and students	4	5	20	High	Machines should be inspected and secured properly	
46	EETW	Fuses and circuit	Inappropriate fuse ratings	Overloading, fire	Teacher and students	4	5	20	High	Fuses and circuit breakers should be checked regularly and appropriate ratings used	
47	EETW	Fire precautions	Incorrect storage of flammable materials	Fire, explosion	Teacher and students	4	5	20	High	Flammable materials should be stored safely and fire extinguishers should be accessible	

48	**EETW**	Workbench	Leaving unused equipment and items on the workbench	Minor injuries while working at the workbench	Teacher and students	**3**	**2**	**6**	**Low**	Equipment should be stored in cabinets after use and workbench surfaces should be kept clear	
49	**EETW**	Chemicals	Disorganized chemicals on the workbench	Chemical exposure, injuries	Teacher and students	**3**	**3**	**9**	**Medium**	Chemicals should be stored in ventilated cabinets on separate shelves according to their properties and not left in the laboratory after work is completed	
50	**EETW**	Materials in the storage	Disorganized and unnecessary storage materials	Fire hazard, snagging, falling	Teacher and students	**2**	**5**	**10**	**Medium**	Stored materials should be removed appropriately	
51	**EETW**	Cable conduits	Damaged/Broken/Open Cable Channel Covers	Exposure to electric current	Teacher and students	**3**	**5**	**15**	**High**	Repair and maintenance should be carried out on damaged or broken sections	
52	**EETW**	Waste disposal	Absence of lidded and bagged trash bins	Various infectious diseases	Teacher and students	**3**	**3**	**9**	**Medium**	rash bins for waste should be equipped with bags, and those with automatically closing lids should be preferred.	

53	EETW	Chemical mixtures	Preparation of chemical mixtures	Chemical contact with eyes, inhalation, ingestion, and skin irritation	Teacher and students	3	3	9	Medium	Warning signs regarding PPE use should be posted on workshop walls (clearly visible from all angles) and spare PPE should be available in the workshop and laboratory	
54	EETW	Operations under ...	Contact with electricity and collision	Various burns, injuries, and death	Teacher and students	5	5	25	Extreme	Behavior-based safety training, awareness programs, and checklist inspections should be implemented	
55	EETW	Cable organization	Disorganized cables, loose connections	Snagging, falling, short circuit, fire	Teacher and students	3	4	12	Medium	Cables should be secured, regularly checked, and cable channels should be used	
56	EETW	Grounding systems	Incomplete or faulty grounding	Electric shock, device malfunctions	Teacher and students	5	5	25	Extreme	Regular grounding measurements should be performed and appropriate materials used	
57	EETW	Emergency procedures	Insufficient emergency exits, lack of warning systems	Delayed intervention in case of fire or electrical failures	Teacher and students	4	5	20	High	Emergency exits should be kept clear, emergency training provided, and warning signs posted	

ABBREVIATIONS:
EETW: Electrical-Electronics Workshop
P.P.E.: Personal Protective Equipment MSDS: Material Safety Data Sheet

4. Conclusions

This study employed the 5x5 L-type matrix method to identify environmental hazards and associated risks within the workshops and laboratories of a vocational high school's Electrical-Electronics Technology Department. Furthermore, we have suggested steps in

compliance with rules to mitigate each identified risk to an acceptable threshold.

As a result;

A total of 57 dangers were discovered, categorized as 3 extremely high risks, 24 high risks, 25 medium risks, and 5 low (acceptable) risks. The identified risks have revealed significant issues, including inadequate emergency management, ineffective waste management, improper use of personal protective equipment (PPE), inconsistent maintenance procedures, fire safety deficiencies, incorrect chemical storage, noncompliance with electrical panel regulations, and the absence of Material Safety Data Sheets (MSDS).This article proposes several recommendations to address these deficiencies and establish a safe and healthy laboratory environment.

- A safety policy for technical workshops must be established, and workshop supervisors should be designated and authorized to manage safety-related issues in compliance with this policy. A workshop hygiene strategy must be developed and regularly assessed for its implementation.
- Chemicals must be stored and labeled according to appropriate physical conditions corresponding to their classification. Material Safety Data Sheets (MSDS) must be provided for each chemical and stored in a location accessible to all personnel.

-Waste management protocols must be established, and all participants in the workshops should be apprised of these regulations. Waste from various workshops must be disposed of individually, without amalgamation. Chemical waste must not be disposed of in sinks.

- Emergency action plans must be developed, and all participants in the workshop, including students, should be apprised of these protocols.

- Operating instructions must be documented for all workshop equipment and prominently displayed.

- Given that the majority of chemicals are poisonous, combustible, corrosive, and reactive, increased storage correlates with elevated risk. Consequently, chemicals must be stored at the minimal requisite level to mitigate any dangers.

- Workshop instructors must be trained in the contents of the first aid pack, fundamental injury response techniques, and the correct utilization of fire extinguishers.

-As workshops are environments where serious work takes place, pranks and other disruptive behaviors that may compromise safety should be strictly avoided.

-Workshop materials must not be taken outside the workshop under any circumstances. Furthermore, items such as food and beverages should not be brought into the workshop environment.

-Lab coats should be worn during workshop activities, and to prevent injuries from electrical arcs, chemical splashes, or falling heavy, sharp, or piercing tools, open-toed shoes should not be worn.

Author's Contribution

The contribution of the authors is equal.

Conflict of Interest

The authors have declared that there is no conflict of interest.

Ethics Committee Approval

This study does not require ethics committee approval.

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