Results

The results of this study are presented in four parts:

Part I: Assessment of studied sample characteristics (tables 1-2).

Part II: Students knowledge about the hazards that may face them inside the workshops and safety measures (tables 3-10).

Part III: Assessment of the students' training workshops environment affecting their safety (tables 11- 16).

Part IV: Relation between students' knowledge about hazards and their personal and educational characteristics (tables 17- 20).

Part I: Assessment of Studied Sample Characteristics

Table 1: Distribution of the studied group according to their personal characteristics.

Frequency / Personal & Education Characteristic	No n =333	% 100.0
Age		
15-	88	26.43
16-	100	30.03
17-	38	11.41
18-	90	27.03
19	17	5.11
Mean ± SD	16.555± 1.2803	
Sex		
Male	219	65.77
Female	114	34.23
School grade		
First year	111	33.33
Second year	111	33.33
Third year	111	33.33
Department		
Electric workshops	73	21.92
Welding workshops	38	11.41
Precision equipment	38	11.41
Building carpentry workshops	35	10.51
Cooling and air condition workshops	38	11.41
Electronic appliances workshops	38	11.41
Manmade clothes' workshops	38	11.41
Architectural finishes	35	10.51
Training courses		
First aid	1	0.30
Nothing	332	99.70

Table (1), shows the personal characteristics of the present study among sample of students. It included age, sex, school grade, department and training courses. An equal percentage of one third (33.33%) of studied group was enrolled in each scholastic year, slightly less than one third (30.3%) of studied group were within age group of 16-< 17 years with mean age of 16.55± 1.28 years and a range 15-19years. Approximately two thirds (65.77%) of the studied group were males. In relation to department, slightly more than one fifth (21.92%) of the studied group were in electrical department, and most (99.70%) of the studied group did not got any training course.

Table 2: Distribution of hazards that students are exposed to inside workshop (n=333)

Hazards	No	%
Mechanical hazards	9	2.7
Electrical hazards	111	33.3
Chemical hazards	4	1.2
Never	209	62.8
total	333	100.0

Table (2) reveals the different types of hazards that students were exposed to inside the workshops. One third (33.3%) of studied students are exposed to electrical hazards, while the minorities of them (1.2%) are exposed to chemical hazards.

Part II: Students' Knowledge about the Hazards that may face them Inside the Workshops and Safety Measures

- Research question (1): Is the students have any information about environmental health hazards which facing them in the workshop? (Table 3).

Table 3: Distribution of students' knowledge regarding hazards that may face them inside the workshop (n=333)

Students' knowledge about hazards	No	%
# Mechanical Hazards		
Log in some of body parts between machines	142	42.64
Walk on sharp objects	26	7.81
Solid heavy collision	45	13.51
Flying light objects in the form of reich affecting the eye and skin	189	56.76
# Electrical Hazards		
Contact with non insulated wires	143	42.94
Contact with a damaged motor	57	17.12
Separation of ground	15	4.50
Short circuit	224	67.27
# Chemical Hazards		
Chemical liquids	60	18.02
Gases	147	44.14
Caustic	130	39.04
# Physical Hazards		
High temperature	105	31.53
High humidity	59	17.72
Low temperature	33	9.91
Low in the intensity of vision	77	23.12
Loss in the ability to concentrate	52	15.62
Professionals' loss of hearing	160	48.05

(#) Answers are not mutually exclusive.

Table (3): reveals that more than half of the studied group reported that flying light objects in the form of reich in the eye is the most common type of mechanical hazards affecting them (56.76%), followed by log in some of the body between the machines (42.64%). however, walk on sharp objects was known by few of them only (7.81%). Approximately two thirds reported that electrical hazards may be due to short circuit (67.27%). Conversely, the minority of them (4.50%) mentioned that electrical hazards may be due to separation of ground. More than two fifth (44.14%) revealed that chemical hazards are caused by gases, while less than one fifth (18.02) revealed that chemical hazards are caused by chemical liquids. Concerning physical hazards, the same table indicates that less than half had correct knowledge as they were due to loss in the ability to concentrate (48.05%). Conversely, for the minority of them, correct knowledge attributed it to low temperature (9.91%) as a cause for physical hazards.

- **Research question (2): Is the students have any information about safety measures? (Tables 4 - 9).**

Table 4: Distribution of students knowledge regarding safety measure (n=333).

Safety Measures	No	%
# Objectives of industrial safety in the school		
Preventing exposure of the students to accident and injury	213	63.96
Increasing production according to their performance in the field of services	74	22.22
Providing comfortable atmosphere for students on duty	64	19.22
Conservative on machinery and equipment from damage	94	28.23
Do not know	118	35.44
Presence of committee of industrial safety in the school		
Yes	78	23.42
No	225	76.58
Committee responsibilities		
Inspection on departments	125	37.54
Writing reports on industrial safety	125	37.54
Registration of accidents	7	2.10
Do not know	76	22.82

(#)Answers are not mutually exclusive.

Students' knowledge about safety measures is presented in table (4). Less than two thirds (63.96%) reported that the objectives were preventing exposure of the worker to accident and injury, while slightly less than one fifth (19.22%) reported that they were providing comfortable atmosphere for students on duty. As regards presence of committee of industrial safety in the school, more than three quarters (76.58%) had no knowledge about it. As regards the committee responsibilities, writing reports on industrial safety and inspection on departments were known by more than one third (37.54%), while only (2.10%) of students cited registration of accidents as a responsibility of the committee.

Table :-(5) Distribution of students' knowledge and practice regarding prevention of electrical hazards (n=333).

Students' knowledge regarding prevention of electrical hazards	No	%
# **Prevention of electrical hazards**		
Electrical connection in the workshops is safe	108	32.43
providing automatically cut-of switch when power problem occurs	169	50.75
Connecting the machine with landslide	28	8.41
Maintenance of electrical appliances regularly	140	42.04
# **Means to prevent electrical hazards in the workshop**		
Presence of abroad warning signs for touching electrical appliances	200	60.06
Providing gloves buffer	69	20.72
Maintenance of electrical wiring	138	41.44
# **Action taken if a short circuit occurs in the workshop**		
Disconnect the electrical current from the workshop	315	94.59
Separating machine where there was a short circuit	40	12.01
Keeping away from place of short circuit	41	12.31

(#)Answers are not mutually exclusive.

Table (5) presents that, approximately half of students (50.75%) agreed on providing automatically cut-of switch when power problem occurs as a means to prevent electrical hazards, followed by more than two fifths (42.04%) for maintenance of electrical appliances regularly. Connecting the machine with landslide was known by few of them only 8.41%. Almost three fifths (60.06%) reported that providing of abroad warning signs for touching electrical appliances is an important means to prevent electrical hazards in the workshop, while slightly more than one fifth (20.72%) reported providing gloves buffer. Concerning action taken if a short circuit occurs in the workshop, the most of students (94.59%) stated that disconnection of the electrical current from the workshop is an

important action (94.59%), while only 12.01% have mentioned separating machine where there was a short circuit.

Table 6: Distribution of students' knowledge regarding fire prevention (n=333).

Students' knowledge regarding fire prevention	No	%
# **Fire prevention**		
There are an emergency exit	37	11.11
There are fire extinguishers	282	84.68
Safely storing of flammable materials	42	12.61
Training to deal with fires	56	16.82
# **Available means to control the fire inside the workshop**		
Fire extinguishers	309	92.79
Water pipes	122	36.64
Source of water (fire taps)	74	22.22
Buckets of sand	123	36.94
Fire alarm	33	9.91
Ability for using fire extinguishers		
Yes	81	24.3
No	252	75.7
# **Action taken during fire**		
Close the windows	32	9.61
Separate power supply	314	94.29

(#)Answers are not mutually exclusive.

Table 6 indicates that, the majority of students reported that fire extinguishers should be available to protect themselves (84.68%), Most students (92.79%) stated that fire extinguishers were the important mean that must be available inside workshop. Conversely, a few number of them (9.91%) reported fire alarm. Approximately three quarters (75.7%) reported their disability for using fire extinguishers, and most of them (94.29%) agreed on that separation of power supply is a suitable action during fire.

Table 7: Distribution of students' knowledge regarding mechanical hazard prevention (n=333).

Students' knowledge regarding mechanical hazard prevention	No	%
1- Machines		
Machines are lubricated on regular basis	325	97.60
#**Safety devices that must be met when dealing with the machine**		
Presence of suitable distance between the students and the machine and also between machines and some of them	130	39.04
Presence of special activation key for each machine	191	57.36
Presence of safety barriers	110	33.03
# **Conditions to be fulfilled by the safety barriers**		
To make the maintenance and lubrication of the machines easy	62	18.62
To prevent the students from exposure to hazards during working on the machine	255	76.58
It shouldn't be a reason to disrupt production	50	15.02
2- Manual tools		
# **Conditions that must be met with manual tools**		
Hands must be undamaged	255	76.58
Armoury must be undamaged	184	55.26
# **Caring for hand tools**		
Saved in special cabinets	283	84.98
Lubrication of hand tools	119	35.74
Removing reich	110	33.03

(#) Answers are not mutually exclusive.

Table (7) describes students' knowledge about mechanical hazard prevention. First, about machines; most of the sample (97.60%) reported that the machines are lubricated on regular basis, more than half (57.36%) agreed on presence of special activation key for each machine to protect them from hazards. However, about one third (33.03%) agreed on presence of safety barriers. More than three quarters (76.58%) of students stated that safety barriers should prevent the worker from exposure to hazards during working on the machine; and15.02 % said that it shouldn't be reason to disrupt production. Second, about hand tools; slightly more than three quarters (76.58%) of students agreed on that the hands must be undamaged, while more than half (55.26%) reported that the armoury must be undamaged. The majority of students (84.98%) reported that hand tools should be saved in special cabinets, while about one third (30.03%) agreed on removing reich to care for hand tools.

Table 8: Distribution of students according to their knowledge about personal protective equipment (n=333).

Students' knowledge regarding personal protective equipment	No	%
# **Necessary equipment for personal protection inside the workshop**		
Needed equipments are:		
Protective shoes	75	22.52
Helmets	61	18.32
Face masks	74	22.22
Goggles	83	24.92
Scarves network	26	7.81
Gloves	56	16.82
Ear plug	36	10.81
Wearing coats and it must be locked when working on the machine	223	66.97
There is no	44	13.21
Barriers to use personal protection equipment		
Losing time	110	33.03
Not available	187	56.16
Unsuitable	36	10.81

(#) Answers are not mutually exclusive.

Table (8) describes that, approximately two thirds (66.97%) of students stated that wearing coats and it must be locked when working on the machine is an important means for personal protection, followed by more than one fifth (24.92%, 22.52% & 22.22%) were goggles, protective shoes from slipping, and face masks respectively. Scarves network were known by few of them only (7.81%). More than half (56.16%) reported that unavailability of personal protection equipment is a barrier to use them, while 10.81%reported that personal protection equipment are unsuitable.

Table 9: Distribution of students' knowledge about first aid kit (n=333).

Students' knowledge regarding first aid kit	No	%
Presence of program for training in the school about first aid		
Yes	133	39.94
No	200	60.06
# **Contents of first aid kit**		
Cotton	251	75.38
Gauze	213	63.96
Disinfectant	239	71.77
Salt solution	99	29.73
Ointment for burns	166	49.85
Compression bandage	145	43.54

(#) Answers are not mutually exclusive.

Table (9) shows that, three quarters of students had correct knowledge about cotton (75.38%). However, only more than one quarter had correct knowledge about salt solution (29.73%). In relation to presence of program for first aid to train students in the school, more than one third (39.94%) stated the availability of program for training about first aid.

Table 10: Distribution of students' knowledge regarding the role of the medical team in providing safety school environment and protecting students from health hazards (n=333).

Items	No	%
# **Role of physician in providing a safe school environment and protecting students from risks**		
Regular medical examination for students	175	52.55
Treatment of students who are exposed to accidents in the school	140	42.04
Medical examination for students at the beginning of the year	102	30.63
Students training on first aid	43	12.91
# **Role of the nurse in providing a safe school environment and protecting students from risks**		
Give health education on how to avoid accidents in the school workshops	176	52.85
Providing first aid required during accidents	180	54.05
Making school environment healthy and safe	100	30.03

(#) Answers are not mutually exclusive.

Table (10) shows the role of the medical team in providing a safe school environment and protecting students from risks. Regarding role of physician, slightly more than half (52.55%) reported providing regular medical examination for students, about two fifths (42.04%) agreed on

providing treatment to students who are exposed to accidents in the school and only 12.91% stated training students on first aid. As regards role of school nurse, more than half (54.05%) agreed upon her role in providing required first aid during accidents, while less than one third (30.03%) mentioned that her role is keeping school environment healthy and safe.

Part III:-Assessment of the students' training workshops' environment affecting their safety.

Table11: Distribution of workshops regarding availability of cleanliness and housekeeping, and communication facilities.

Items	Available		Not Available	
	No	%	No	%
Cleanliness &housekeeping				
All items of workshop equipment are suitably arranged to avoid overcrowding.	18	78.26	5	21.74
Workshop is clean & clear of obstructions	17	73.91	6	26.09
Workshop floor is dry.	20	87.0	3	13.0
Floor is non slippery	22	95.65	1	4.3
Eating and drinking are prohibited in the workshop area.	14	60.9	9	39.1
Washing facilities and materials are adequate.	1	4.35	22	95.65
Communication facility				
A telephone is present in the school and functioning	23	100.00	0	0.00
A telephone is present in every workshop and functioning	0	0.00	23	100.00
A list of emergency telephone number present in every workshop	0	0.00	23	100.00

Table (11) displays the observed workshops regarding cleanliness and housekeeping, and communication facility. Most (95.65%) of

workshops did not have adequate washing facilities and materials, while for 95.65% and 87.0% of workshops floor is non slippery and dry, respectively. According to communication facility, there is no telephone in any workshop and there is no a list of emergency telephone number present in every workshop.

Table12: Distribution of workshops regarding adequacy of lighting and ventilation.

Items	Available		Not Available	
	No	%	No	%
Lighting				
The general level of illumination of the workshop is adequate for the work to be carried out.	21	91.30	2	8.70
Windows are available, adequate, and with proper distribution	21	91.30	2	8.70
Number of lamps is suitable and functioning.	21	91.30	2	8.70
Proper distribution of lamps	21	91.30	2	8.70
Lighting system doesn't cause glare.	20	86.96	3	13.04
Ventilation				
General ventilation of the workshop area is satisfactory	22	95.65	1	4.35
Temperature in the workshop is suitable for the work to be carried out.	22	95.65	1	4.35
Fans are available and functioning	10	43.5	13	56.5
Fans are properly distributed in the workshops	10	43.5	13	56.5

Table (12) represents the observed workshops regarding lighting and ventilation. Most (91.30%) of workshops have adequate general level of

illumination, and windows, number of lamps is suitable and functioning, and there is proper distribution of lamps. According to ventilation, most (95.65%) have satisfactory ventilation and temperature is suitable for the work to be carried out, while fans aren't available and functioning and not properly distributed in more than half of workshops (56.5%).

Table13: Distribution of workshops regarding availability of general fire prevention requirements.

Items	Available		Not Available	
	No	%	No	%
General fire requirements Accumulations of flammable or combustible waste materials and residues are removed	23	100.00	0	0.00
Fire exit is available	3	13.0	20	87.0
All exit paths from the workshop are clear of obstruction and suitably sign posted.	6	26.1	17	73.9
A least one fire extinguisher is available in each laboratory, shop or other vocational room	22	95.65	1	4.35
Fire extinguishers are enclosed in cabinets, and cabinets unlocked	10	43.5	13	56.5
Extinguisher operating instructions are located on the front of the extinguisher and clearly visible.	15	65.2	8	34.8
Fire extinguishers are fully charged and operable and kept in their designated places at all times	17	73.9	6	26.1
Sand pails are available	14	60.9	9	39.1
Sand pails are distributed near danger places.	11	47.8	12	52.2
Smoking is prohibited in the workshop.	6	26.1	17	73.9
Fire alarm is easily audible above machinery noise.	0	0.00	23	100.00
Fire hoses are available.	0	0.00	23	100.00
Fire hoses are in good condition (no holes).	0	0.00	23	100.00
Presence of non flammable wall	0	0.00	23	100.00

Table (13) shows the observed workshops regarding general fire prevention requirements. At all workshops, no accumulations of flammable or combustible waste materials, and residues are removed, for the majority of workshops (87.0%) they didn't have fire exit, and exit paths aren't clear of obstruction (73.9%). Less than three quarters (73.9%) of workshops have fire extinguishers fully charged and operable. In slightly more than one forth of workshops (26.1%) smoking is prohibited. At all workshops (100.0%) no fire alarm is available as well as no fire hoses.

Table14: Distribution of workshops regarding electrical general requirements and machine safeguarding.

Items	Available		Not Available	
	N0	%	N0	%
Electrical general requirements Electrical panels are closed	23	100.00	0	0.00
Electrical panels are easily accessible	23	100.00	0	0.00
Every switch in control panel is labeled	14	60.86	9	39.14
Acceptable types of cables are used in cable trays	23	100.00	0	0.00
Each machine has its own electrical switch	23	100.00	0	0.00
There is a master control switch for all machines.	23	100.00	0	0.00
Safety signs, safety symbols, or accident prevention tags are used where necessary to warn students/teachers about electrical hazards.	21	91.30	2	8.70
Machine safe guarding All machines are guarded to protect the operator and other people in the machine area from hazards	10	43.5	13	56.5
All machines are provided with a power cut off switch that can be reached from the operating position	23	100.00	0	0.00
Safety instruction about machine danger and using precaution are available near each machine	4	17.4	19	82.6

Table (14) shows the observed workshops regarding electrical general requirements and machine safeguarding. According to electrical general requirements, at all workshops (100.0%) electrical panels are closed, easily accessible, acceptable types of cables are used in cable trays and each machine has its own electrical switch and there is a master control switch for all machines. However, for almost two fifth (39.14%) of workshops, every switch in control panel isn't labeled. As regards machine safeguarding, all machines in all workshops are provided with a power cut off switch that can be reached from the operating position, while more than half(56.5%) of workshops, all machines are guarded to protect the operator.

Table 15: Distribution of workshops regarding the usage of personal protective equipments

Items	Available		Not Available	
	No	%	No	%
Body protection				
Coats Leather apron is available	0	0.00	23	100.00
Clothes are made of cotton	23	100.00	0	0.00
Teachers wear safety clothes.	3	13.04	20	86.96
Students wear safety clothes (lab coats) .	23	100.00	0	0.00
Head protection Protective helmets are used.	0	0.00	23	100.00
Teachers wear head protection devices	0	0.00	23	100.00
students wear head protection devices	0	0.00	23	100.00
Hand protection Appropriate protective gloves	0	0.00	23	100.00
Teachers wear hand protection devices	0	0.00	23	100.00
Students wear hand protection devices	0	0.00	23	100.00
Feet protection Safety boots are available in metal workshops.	0	0.00	23	100.00
Leather feet protection is available in welding area	0	0.00	23	100.00
Teachers wear feet protection devices	0	0.00	23	100.00
Students wear feet protection devices	0	0.00	23	100.00

Table (15) shows the observed workshops regarding personal protective equipment. According to body protection, all students (100.0%) wear safety clothes (lab coats only) and they are made of cotton in all workshops. However, only 13.04% of teachers wear safety clothes. As regards head protection, no protective helmets are used, as neither teachers nor students wear head protection devices. According to hand protection, there are no protective gloves. All (100.0%) teachers and students didn't wear head protection devices. According to feet

protection, there is no safety boots in all workshops. Teachers and students didn't wear feet protection devices.

Table 15.a: Distribution of workshops regarding personal protective equipment

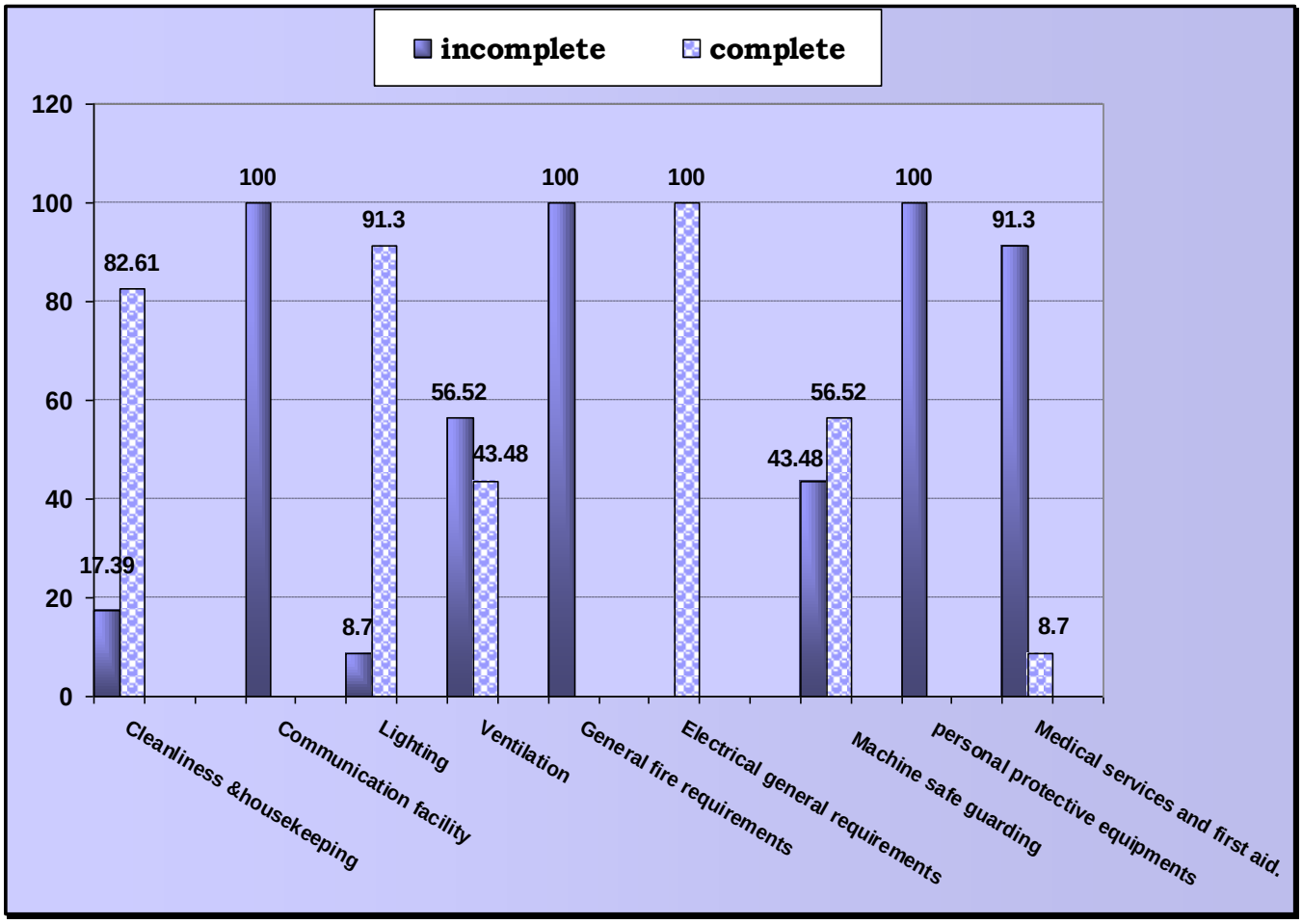
Items	Available		Not Available	
	No	%	No	%
Respiratory protection				
Masks are available	0	0.00	23	100.00
Teachers wear respiratory protective devices	0	0.00	23	100.00
Students wear respiratory protective devices	0	0.00	23	100.00
Face, eye & ear protection				
Face shields made from non flammable material are available	2	8.70	21	91.30
Appropriate number of goggles are available	2	8.70	21	91.30
Ear muffs are available in noisy area	0	0.00	23	100.00
Ear plugs are washed after each use	0	0.00	23	100.00
Teachers wear face, eye & ear protection devices.	0	0.00	23	100.00
Students wear face, eye & ear protection devices	1	4.35	22	95.65

Table (15-a) shows the observed workshops regarding personal protective equipments, as regards respiratory protection, there is no masks available. Teachers and students didn't wear respiratory protective devices. According to face, eye and ear protection, in most of workshops, (91.30%) no face shields are available as well no appropriate number of goggles (91.30%) are not available. However, there are no ear muffs available in noisy area. All teachers (100.0%) didn't wear face & eye and ear protection devices, while most (95.65%) of students didn't wear face, eye and ear protection devices.

Table16: Distribution of workshops regarding availability of medical services and first aid.

Items	Available		Not Available	
	No	%	No	%
Medical services and first aid				
Medical personnel	23	100.00	0	0.00
First aid box present and easily accessible	5	21.74	18	78.26
Adequate first aid supplies	2	8.70	21	91.30
Clear label on each supply	0	0.00	23	100.00

Table (16) shows the observed workshops regarding medical services and first aid. First aid box is not present in slightly more than three quarters (78.26%) of workshops, in most (91.30%) of workshops there isn't adequate first aid supplies, and each supply is not clearly labeled in all workshops.


incomplete
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Cleanliness &housekeeping
Communication facility
Lighting
Ventilation
General fire requirements
Electrical general requirements
Machine safe guarding
personal protective equipments
Medical services and first aid.

Figure (1): Total score of the students' training workshops' environment affecting their safety.

It is obvious that, all workshops had incomplete safety measures regarding communication facility, general fire prevention requirement and personal protective equipment, while all workshops had complete safety measures regarding general electrical requirements.

In relation to research questions number (3 -4)

Research question (3): Is there relationship between using the safety measures and the students' characteristics?

Research question (4): Is there relationship between using the safety measures and the students' information about it?

According to table (15) the students did not wear personal protective equipment except lab coats, so there was no relation between usage of safety measures and students' characteristics or their information about it.

In relation to research questions number (5):

Research question (5): Is there relationship between unhealthy school workshop environment and occurrence of health hazards among secondary technical schools students?

Table (11) indicated that all workshops did not have a telephone in them and most of them did not have adequate washing facilities and materials. Most of them have improper ventilation which may lead to more hazards in the workshops.