ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE ON LABORATORY SAFETY IN UNIVERSITY MALAYSIA KELANTAN

by

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DECLARATION

I declare that this thesis entitled "Assessment of Knowledge, Attitude and Practice on Laboratory Safety in University Malaysia Kelantan" is the result of my own research except as cited in the references. The thesis has not been accepted fpr any degree and is not concurrently submitted in the candidature of any other degree.

Signature :

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ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE ON LABORATORY SAFETY IN UNIVERSITY MALAYSIA KELANTAN

ABSTRACT

Though anyone who comes into contact with potentially harmful compounds should be concerned about their safety, people who work with harmful chemicals on frequently, including students and lab workers, are especially at risk. Inappropriate behaviour could result in mishaps. A few examples of laboratory mistakes include a chemical-related fire in the Department of Chemistry at the University of Malaya in 2001 and a laboratory at the School of Applied Physics at Universiti Kebangsaan Malaysia in 2005. A survey about knowledge, attitudes, and practices regarding laboratory safety has been undertaken among students at Universiti Malaysia Kelantan. Furthermore, this study with the objective of to evaluate the degree of knowledge, attitude, and actions regarding laboratory safety on students and to compare mean of knowledge, attitude, and practice by demographic in laboratory safety.as well as the relationship between the knowledge, attitude, and practices regarding laboratory safety. In order to conduct the survey for this study, questionnaires are distributed using an internet platform. This survey includes about 338 participants UMK. The data have been analysed using ANOVA, descriptive analysis, and inferential analysis of independent t-test. This research will support University Malaysia Kelantan's efforts to ensure student safety in the lab, there is a need to understand how students perceive laboratory safety and how aware students are of laboratory safety actions. Because not everyone can tolerate laboratory safety in the laboratory. The correlation between knowledge and attitude show high correlation ($r = 0.722$, $N = 338$, $p < 0.05$). This study shows that the respondents were aware of the laboratory safety while in experiment. Therefore, the respondents realize that laboratory hazard will occur accident if take it for granted or did not used PPE. So, a number of recommendations may be required to increase awareness of the importance of laboratory safety based on the survey's results.

PENILAIAN PENGETAHUAN, SIKAP DAN AMALAN TERHADAP KESELAMATAN MAKMAL DI UNIVERSITI MALAYSIA KELANTAN

ABSTRAK

Walaupun sesiapa yang tersentuh dengan sebatian yang berpotensi berbahaya harus mengambil berat tentang keselamatan mereka, orang yang kerap menggunakan bahan kimia berbahaya, termasuk pelajar dan pekerja makmal, amat berisiko. Tingkah laku yang tidak wajar boleh mengakibatkan kemalangan. Beberapa contoh kesilapan makmal termasuk kebakaran berkaitan kimia di Jabatan Kimia di Universiti Malaya pada tahun 2001 dan makmal di Pusat Pengajian Fizik Gunaan di Universiti Kebangsaan Malaysia pada tahun 2005. Tinjauan tentang pengetahuan, sikap dan amalan mengenai keselamatan makmal telah dilaksanakan dalam kalangan pelajar Universiti Malaysia Kelantan. Seterusnya, kajian ini bertujuan untuk menilai tahap pengetahuan, sikap, dan tindakan mengenai keselamatan makmal terhadap pelajar dan membandingkan min pengetahuan, sikap dan amalan mengikut demografi dalam keselamatan makmal. serta hubungan antara pengetahuan, sikap, dan amalan mengenai keselamatan makmal. Bagi menjalankan tinjauan bagi kajian ini, borang soal selidik diedarkan menggunakan platform internet. Tinjauan ini merangkumi kira-kira 338 peserta UMK. Data telah dianalisis menggunakan ANOVA, analisis deskriptif, dan analisis inferensi ujian-t bebas. Penyelidikan ini akan menyokong usaha Universiti Malaysia Kelantan untuk memastikan keselamatan pelajar di makmal, terdapat keperluan untuk memahami bagaimana pelajar melihat keselamatan makmal dan sejauh mana pelajar menyedari tindakan keselamatan makmal. Kerana tidak semua orang boleh bertolak ansur dengan keselamatan makmal di makmal. Kolerasi antara pengetahuan dan sikap menunjukkan korelasi yang tinggi ($r = 0.722$, $N = 338$, $p < 0.05$). Kajian ini menunjukkan bahawa responden sedar tentang keselamatan makmal semasa menjalankan eksperimen. Oleh itu, responden menyedari bahawa bahaya makmal akan berlaku kemalangan jika mengambil mudah atau tidak menggunakan PPE. Jadi, beberapa cadangan mungkin diperlukan untuk meningkatkan kesedaran tentang kepentingan keselamatan makmal berdasarkan keputusan tinjauan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

ANOVA	Analysis of Variance
FSB	Faculty of Earth Sciences
FIAT	Faculty of Agro-Based Industry
FBKT	Faculty of Bioengineering and Technology
FPV	Faculty of Veterinary Medicine
OSHA	Occupational Safety and Health Administration
UMK	Universiti Malaysia Kelantan

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Working in a laboratory might be hazardous due to the surroundings. The truth is that many of these incidents have happened, including fatalities that have been confirmed by university laboratories both locally and globally. In laboratory accidents, these problems are often caused by a lack of respect to safety rules and a weak safety culture (Ayi & Hon, 2018). Therefore, effective facilities and equipment, suitable training, personal protective equipment, chemical management, standard operating procedures, waste disposal, signage, acceptable laboratory practices, and secure working conditions are all part of good laboratory safety practices ("Laboratory safety. EHS," 2020). The primary causes of laboratory accidents include unsafe attitudes, inadequate awareness of safety protocols, and inappropriate laboratory activities. (Hussein & Shifera, 2022).

Identifying threats, evaluating potential risks, reducing potential risks, and getting ready for emergencies (RAMP) are the four safety principles that need to be actively implemented in the lab to guarantee worker safety. To keep oneself and others safe when working in a laboratory, one must adhere to all four of these guidelines (Hill, 2019). There seem to be a regular occurrence worldwide of a number of laboratory mishaps involving students and personnel that cause serious injuries or even death. For instance, on December 26, 2018, three students engaged in a landfill leachate experiment perished at the Beijing Jiao tong University laboratory following an explosion (Chinadaily, 2018).

In addition, in laboratories, biological and chemical hazards can arise from a variety of sources and acts, including aerosol exposure, accidents and splashing, unintended needle sticks, injuries from cutting tools and cracked glass, oral pipetting of the solution, and centrifuge incidents (Al-Abhar et al., 2017). Therefore, understanding the dangers and practical steps must be made in laboratories to prevent occupational dangers (Shekhar et al., 2015).

University students pursuing majors in chemistry and other related fields benefit greatly from their training and scientific research in the chemical laboratory. A wide range of dangerous reagents, including those that are combustible, explosive, corrosive, easily oxidising, and irritating, are utilised in chemical laboratories. Other potentially harmful tools, equipment, and instruments include burners, glassware, gas bottles, and instruments with high pressure and temperature. As a result, everyone who comes into contact with potentially dangerous materials or situations involving the hazards associated with using laboratory equipment should take safety into account. Considerable effort has been made to enhance safety education in an effort to reduce accidents (Wu et al., 2020). Thus, the purpose of this study is to assess University Malaysia Kelantan students' knowledge, attitudes, and practices addressing laboratory safety.

1.2 Problem Statement

Though anyone who comes into contact with potentially harmful compounds should be concerned about their safety, people who work with harmful chemicals on frequently, including students and lab workers, are especially at risk. Inappropriate behaviour could result in mishaps. The academic community is now more aware of the risks in academic laboratories as a result of Sheri Sangji's death from pyrophoric drugs at the University of California, Los Angeles (UCLA) in 2008. The United States Chemical Safety and Hazard Investigation Board (CSB) has recorded 120 incidents in academic institutions across the globe since 2001. These incidents have resulted in 87 evacuations, 96 serious injuries, and three fatalities. Along with laboratory mistakes, chemical-related fires and explosions have caused extensive infrastructure damage in Malaysian universities. A few examples of these incidents include a fire in the Department of Chemistry at the University of Malaya in 2001, an engineering lab at Universiti Putra Malaysia in 2002, and a laboratory at the School of Applied Physics at Universiti Kebangsaan Malaysia in 2005 (Zakaria et al., 2022). In addition, kuala lumpur in Malaysia resulting in the afternoon of 9th August 2016, a chemical spill at the Taman Tun Dr. Ismail secondary school in this city caused skin discomfort in 22 children. According to Azizan Ismail, assistant director of operations for the City Fire and Rescue Department, the department was notified of the incident at 4:02 p.m. "A team of firemen from Sri Hartamas including the hazardous material (Hazmat) team was dispatched." The group found that a sulfuric acid bottle had cracked and leaked (Zahratulhayat, 2016).

Nowadays, the government's 2020–2025 Occupational Safety and Health Master Plan (OSHMP25) includes the new policy with the objective of to advance the country's occupational safety and health (OSH) to an exceptional standard while safeguarding human resources, which are essential for carrying out the nation's growth agenda in achieving the Shared Prosperity Vision 2030 (SPV 2030). Outstanding OSH performance will boost occupation, productivity, quality, and life expectancy, all of which help to establish a secure, wholesome, and cosy working atmosphere. This are bound to directly support the country's OSH Policy in order to meet the goals of SPV 2030 and increase the Malaysian Well-Being Index's Working Environment Component Index. The three previous OSH five-year strategy plans are expanded upon by this Master Plan, which were initiated in 2006 with the goal of fostering an environment that is safe and healthy for both companies and employees ("Department of Occupational Safety and Health | Occupational Master Plan 2021-2025," 2023).

Students who frequently handle chemicals, for instance, are especially vulnerable, especially those who work in laboratories. Employees in the laboratory, coworkers, managers, and students must be able to readily explain any hazardous prevention and management strategies for laboratory processes. Furthermore, if pupils lack the knowledge to ensure safe handling and control, the danger of injury may increase (Manuel & Bona, 2021).

For example, three people lost their lives in another incident that occurred at a Beijing laboratory on December 26, 2018. A university laboratory is a valuable resource for scientific research and experimental education. Laboratory safety management is becoming a bigger concern in the face of fire, explosion, and other risks. It is risky to undertake laboratory research given this rise in accident frequency. The challenge of managing laboratory safety grows in size under the threat of fire, explosion, and other issues. It is risky to do laboratory research because of this rise in accident frequency. Numerous research has focused on university lab safety in an effort to improve the current unsatisfactory status (Chen et al., 2020).

Therefore, the aim of the study is thus to assess the level of knowledge, attitude, and practice among students regarding laboratory study to avoid unwanted accidents and therefore offer better comprehension. Positively, it can also increase the understanding among students about the importance of laboratory safety while in laboratories.

1.3 Objective

The objective of this study is mainly:

I. To determine the level of knowledge, attitude, and practice among students regarding laboratory safety at the University Malaysia Kelantan.
II. To compare mean of knowledge, attitude, and practice by demographic in laboratory safety.
III. To assess the relationship between the laboratory safety knowledge, attitude, and practices among students at the University Malaysia Kelantan.

1.4 Scope of Study

This study is focused on the level of the knowledge, attitude, and practice on students towards laboratory safety. Data would be gathered through a series of questions. Primary data was used in this research. Primary data was obtained by survey using questionnaires to the students at University Malaysia Kelantan. This study involved students year one to year four in University Malaysia Kelantan that are exposed to laboratory hazards.

1.5 Significant of Study

This research will support University Malaysia Kelantan's efforts to ensure student safety in the lab, there is a need to understand how students perceive laboratory safety and how aware students are of laboratory safety actions. Because not everyone can tolerate laboratory safety in the laboratory.

Furthermore, this study will help provide data on the level of knowledge, attitude, and practice on laboratory safety in University Malaysia Kelantan. This research is also a significant study to suggest a better way to increase awareness and decrease accidents that happen in the lab. It is because laboratory areas consist of different hazards such as chemical, biological, physical, and radioactive hazards.

CHAPTER 2

LITERATURE REVIEW

2.1 Laboratory Safety

A laboratory is a location outfitted for scientific experimentation, testing, and analysis, and a time period designated in the curriculum for laboratory activity (Merriam-Webster., 2023).Given the current state of knowledge regarding secure laboratory working practices, it is imperative to develop regulations for the medical observation of laboratory workers in addition to globally recognised agreed codes of standard precautions. It is also crucial to use attitude measures to observe and comprehend events based on particular tendencies in order to establish a unified construction. The request for information and rules that finally led to action is how safety measures are practiced (Ahmed et al., 2022).

According to Thirunavukkarasu et al. (2021), a wonderful practice is a creative process that is concerned with the advancement of resources and information and is carried out correctly. The goal of laboratory safety is to keep researchers, other laboratory staff, and non-laboratory personnel healthy and safe. Students as non-laboratory are faced with a number of workplace dangers, so if necessary precautions are not taken, their health may be endangered (El-Gilany et al., 2017). Furthermore, Fukuoka & Furusho (2022) state that in cases involving laboratory safety, it is essential to create guidelines and protocols for experiments in addition to providing education and training to guarantee that participants have a proper understanding of the risks unique to each research project and that the corresponding risk assessment is carried out correctly.

When laboratory safety education moves from a compliance approach to a hazard analysis and risk minimization plan, systems thinking is needed to facilitate stakeholder engagement (O'Neil et al., 2020). Throughout the current research labs, laboratory safety must always come first. To guarantee a safe working environment, dangers in laboratories must be recognised, and hazard controls must be created and put into place (Cadwallader & Pawelko, 2019).

The research by Al-Abhar et al. (2017) revealed that laboratory employees displayed acceptable to poor biosafety understanding and methods, the low proportion of laboratory employees who received training and a biosafety handbook suggests that they were not sufficiently committed to upholding biosafety regulations. It was clear from the study of Koria and Lala (2012) that most laboratory workers did not understand the significance of such a complete approach (Al-Abhar et al., 2017). Therefore, all emplopyee need to be given a thorough explanation of the idea, application, and efficiency of universal precautions (Koria & Lala, 2012).

According to Zaveri & Karia's (2012) study, this highly exposed laboratory personnel had a poor understanding of and adherence to general job precautions. Comprehensive training regarding general safety precautions and expanded work practises by the management of hospitals were among the recommendations offered to reduce inequities (Zaveri & Karia, 2012).

Additionally, the study found that among the laboratory staff that was evaluated, there is a severe lack of information, attitude, and practice of safety precautions. This finding is consistent with the general trend. The medical laboratory staff in the participating hospitals as well as those in comparable contexts, therefore, urgently require training to raise awareness, and knowledge, and to inspire positive change in attitude and practice of universal precaution (Fadeyi et al., 2011).

2.2 Knowledge on Laboratory Safety

Knowledge is the dimension of gaining, remembering, and applying data it is a combination of comprehension, knowledge, judgment, and ability (Herr, 2007). Laboratory knowledge is critical to improving scientific understanding and innovation. Laboratories are places where scientists can conduct experiments, collect data, and analyze the outcomes to develop new knowledge. Acquiring and implementing knowledge in a laboratory setting helps to advance fields ranging from medicine to engineering. Reduce the chance of exposing skin or mucous membranes to potentially infectious materials by wearing personal protection equipment (PPE) such as gloves, face masks, gowns, towels, goggles, or safety glasses. These precautions are part of standard safety procedures. Some judgement must be used since it is impractical to identify the kinds of barriers required for every potential clinical scenario (Mehta & Diwakar, 2021).

For teaching, learning, and conducting research, academic laboratories should be a secure setting. The prevention of probable mishaps and impending injuries shares a common principle and is a key objective in lab settings. Additionally, academic laboratories have a special duty to teach students a culture of safety, the foundation of risk assessment, and an example of ethical behavior near energized objects. While undergraduate laboratory assignments typically consist of applying tried-and-true experiments and techniques, academic research laboratories may use novel methodologies or equipment, the risks of which may not be fully understood by faculty and student researchers. However, faculty should provide practical advice and safety-focused insights to academic administration to help them achieve the crucial goal of making the academic laboratory a place free of electrical risks for both normal experiments and research endeavours (Araneo & Mitolo, 2019).

The first category is knowledge acquisition and dissemination, which highlights studies that examine how knowledge is acquired in various settings, including formal schooling, training courses, and possibilities for professional growth. For example, by investigating the goals, concepts, rules, methods, structural plans, politics, knowledgeable theory, and possible positions of the social worker in political movements, the study's findings demonstrate how social work in South Africa may expand its vocabulary and understanding to bring about change. (Smith, L, 2015). Using the evaluation and measurement method, they were able to appraise the security and occupational hazards management system and identify ten potential dangers, including chemical, radiation, and physical hazards. Hazards associated with heavy machinery, restricted areas, and fire. In their research, they found risks for lab attendants and technicians in the areas of haematology, microbiology, chemistry, virology, and histopathology. It was shown that 61% of the sample had frequent needle stick dangers in addition to injuries. They recommended that controls be put in place to limit exposure to risks and came to the conclusion that workers' attitudes and knowledge about risk observation and mitigation should be given more weight (Dodo et al., 2020).

A critical component of scientific investigation and experimentation is lab safety ("Lab Manager," 2019). Lack of information regarding laboratory safety can have serious and even dangerous repercussions. Untrained workers may not know how to handle dangerous chemicals or operate equipment safely, which can result in accidents and injuries (OSHA, 2021). Property damage in the lab can also be caused by improper handling of materials or equipment, which can be costly to repair or replace. The study of Salazar-Escoboza assert that reducing laboratory accident rates requires students to be committed to safety. As part of their work in laboratories, people may be exposed to and utilise dangerous compounds, which could result in short-term or long-term health problems, possibly even death. The purpose of this study was to develop a survey instrument based on the aforementioned in order to enable the connection of accidents that occur in university labs with the safety atmosphere of the facility. (Salazar-Escoboza et al., 2020). The reason for such an action is that knowledge pertains to an individual's capacity and willingness to operate in a safe manner through education, including taking part in safety courses. Consequently, students' commitment to safety in reacting to emergencies and acting in a safe manner in the laboratory was significantly impacted by the safety knowledge they received from safety training (Abdullah et al., 2020).

Some students think that small chemical spills are harmless and that it's always okay to dispose of chemical waste down the drain. According to Papadopoli et al. (2020), just half of the staff members wear eye protection when handling chemicals, and nearly half of them admitted to eating in the lab. These findings speak the importance of chemical safety standards (Papadopoli et al., 2020). A company with a reputation for risky practices or accidents may also face legal troubles, productivity loss, reputational damage, and health hazards for its employees. To minimize potential hazards and prevent significant repercussions, it is crucial to give priority to laboratory safety and to make sure that employees as students could obtain the necessary training and instruction in laboratory safety protocols.

2.3 Attitude on Laboratory Safety

In the laboratory, attitude is a significant aspect that determines scientific output as well as the entire laboratory environment. According to a study by Feist and Gorman (1998), a curious and passionate mindset enhances scientific discovery and creativity. As proven by Dweck and Leggett's (1988) work on the growth mindset, this attitude develops a readiness to investigate new ideas and challenge established assumptions. Furthermore, O'Connor and colleagues (2016) underline the importance of laboratory discipline and meticulousness, as these characteristics lead to experimental rigor and the creation of dependable.

A wide range of dangerous reagents, including those that are combustible, explosive, corrosive, easily oxidising, and irritating, are utilised in chemical laboratories. Aside from glassware, other potentially harmful tools, equipment, and instruments include burners, gas bottles, and instruments with high pressure and temperature. Therefore, safety should always come first for everyone who comes into touch with potentially hazardous products or circumstances involving the risks involved in operating laboratory equipment. Considerable effort has been made to enhance safety education in an effort to reduce accidents. The institution implements laboratory safety instruction for all of its laborers (Yang et al., 2019).

A risk assessment essentially evaluates what could possibly go wrong or be an accident at work. It also determines whether sufficient safety measures are in place to keep people safe. Employees or workers in any type of employment are entitled to protection against any risk that could arise from a failure to adopt preventative measures. The primary issue was that the laboratory had not conducted a routine risk assessment for almost a year. The purpose of this study is to identify potential risks that may arise from a test, procedure, or activity in the laboratory. To look into how students' attitudes towards safe practice are influenced by their understanding of health and safety procedures in laboratories and how safety practices relate to those attitudes (Dodo et al., 2020).

As stated by Laurent et al. (2020), precarious theories about safety behaviour offer a chance to combine previous and prospective research in order to examine specific people as well as contextual factors concerning safety behaviours. Further discussion is necessary on other aspects that were also found to be closely associated with safety behaviours, such as safety motivation and safety knowledge.

Avoiding negative attitudes and practices in the laboratory has a significant impact on a variety of factors. It guarantees safety by avoiding mishaps and incidents and protecting employees and the environment. The study's conclusions highlighted the advantages and disadvantages of students' knowledge of chemical safety. Researchers evaluated various areas of student safety, including their knowledge and comprehension with chemical danger warning signs and their attitudes toward chemical laboratory safety. Most of the assessment categories showed awareness levels ranging from fair to good, however students' attitudes towards safety in chemical laboratories were lacking. Additionally, it was shown that there were flaws in how personnel handled particular emergency scenarios, include the correct use of fire extinguishers, allowing instructors to explain why students have little prior experience with these kinds of situations (Al-Zyoud, 2019).

The study's attitude assessment, according to Mehta and Diwakar (2021), amply demonstrated the study subjects' improved attitude levels following training. P<.0001 indicated statistical significance in this case. Prior to training, the majority of research participants (82.5%) had intermediate attitudes, followed by 17.5% with excellent attitudes and none with poor attitudes. Following training, it was discovered that 100% of the learners had positive attitudes towards common work precautions.

2.4 Practice on Laboratory Safety

The manual does away with the necessity for lab recordings following each lesson by incorporating interactive simulations, video clips, and formative and summative assessments. Videos make it simple to explain some of the more difficult ideas and methods, and they are perceived by students as a useful tool for preparing for laboratory work. Additionally, it enables students to understand the level of danger associated with laboratory work and to follow safe procedures to prevent such situations (Gamage, 2020). Implementing adequate waste disposal solutions to reduce environmental impact is also part of good laboratory practices. Next, the regular training and awareness programs help to foster a culture of safety and improve the overall laboratory experience (Smith et al., 2019).

According to a survey conducted in Khabour et al., (2018) , Saudi Arabia, approximately 68% of the staff members obtained laboratory safety training., and most (> 80%) of them complied with regulations on the disposal of medical waste, cleaning up spilled samples, and donning gloves and lab coats. Nonetheless, 24.2% of the subjects had previously consumed food, liquids, or gum. While just 67% of respondents said they used to recap needles after blood withdrawal, nearly 18% said they continued to work with a finger cut (Khabour et al., 2018).

Additionally, safety training is crucial since it teaches students how to handle an emergency and set up safe working habits when carrying out laboratory research at all times (Freitas et al., 2019). In addition, in the study by Almutairi et al. (2020, they noted that continual training was critical to enhancing laboratory personnel's knowledge, attitudes, and practices for the prevention of occupational injuries.

Positive good practices increase efficiency and productivity, allowing tests and information analysis to be completed on time. When criticism is absent, cooperation and communication thrive. Overall, laboratories may foster an environment of quality, trust, and scientific growth by embracing positive attitudes and practices. However, according to Ménard & Trant (2019), at this point, no research has been done to investigate the relationship between safe attitude and protective behaviours. In opposition to these positive outcomes on safety concepts, study results on physical safety practices are troubling. A number of investigations have revealed that scientists are hesitant to do safety assessments before beginning clinical trials, interventional and observational. According to Ayi and Hon's 2018 research, 27% of those who were scientists never did any type of risk assessment just before performing laboratory work.

2.5 Accidents in the Laboratory

Taking into account the knowledge, attitudes, and behaviour of researchers in connection to their possibility of being involved in workplace accidents has become imperative. Therefore, it is strongly recommended that efforts be made to reduce workplace accidents by encouraging laboratory personnel to adopt safer attitudes, behaviours, and practices (Almutairi et al., 2020).

Another incident is in Malaysian teaching laboratories, there have been a number of recorded mishaps involving instructors, lab personnel, and even students. The majority of mishaps are caused by improper handling of chemical spills, which eventually result in explosions. 19 children and teachers reportedly felt sick after a 2013 event involving a tiny explosion because of a potent chemical scent (Paul et al., 2022). It is crucial to recognize the significance of laboratory safety and give it high attention in the lab. Many staff and student is now more exposed to damage because the laboratory hazard was left behind or looked down upon.

Additionally, a student was using a rotary evaporator to remove solvent from a precipitate as part of an undergraduate research assignment. The student's protective goggles rebounded off the exploding round-bottom flask, cutting her forehead, as she touched it. After being taken to the hospital, the student received treatment, including stitches for the incisions above her eyes. Tetrahydrofuran (THF), one of the solvents, was shown to have large quantities of peroxides after further investigation. The findings of this study suggest that although the undergraduate was probably protected from harm by the eye goggles probably was wearing, although she was not aware of them, associated with peroxide-forming solvents (Hill, 2019). There have already been a few slight studies, dealing with the occurrence of research lab-related accidents. In a study of 2,400 scientists conducted by Nature and UCLA (2008), 30% claimed to have seen a lab accident sufficiently serious enough to require healthcare. A brief pilot investigation into 56 laboratory employees in Canadian chemical and biological laboratories discovered that 15% had been injured. (Ménard & Trant, 2019).

CHAPTER 3

METHODOLOGY

3.1 Study Area

Three faculties in Jeli Campus and one faculty in City Campus in University Malaysia Kelantan as all science program have been selected as the study area. The methodology that would be employed included surveying by primary data collection, which would involve gathering survey forms from the study area which were the Faculty of Earth Sciences, the Faculty of Agro-Based Industry and the Faculty of Bioengineering and Technology at Jeli Campus, and Faculty of Veterinary Medicine at the City Campus. Table 3.1 has shown each faculty with its coordinate.

Table 3.1: The coordinate of the study area

Faculty	Coordinate
Faculty of Agro-Based Industry	5°44’44” N, 101°51’50” E
Faculty of Earth Sciences	5°44’43” N, 101°52’05” E
Faculty of Bioengineering and Technology	5°44’44” N, 101°51’51” E
Faculty of Veterinary Medicine	6°08’16” N, 102°18’03” E

3.1.1 Sample Size

False results were likely to result from having too few samples while collecting too many samples would waste time, effort, and resources. The population size must first be determined in order to determine the sample size. The appropriate sample size for most studies is greater than 30 but fewer than 500 (Cotton, 1975).

The population of students in both University Malaysia Kelantan Jeli Campus and City Campus is 2714 students (Table 3.2) from each faculty according to semester years.

Table 3.2: Total population of Students in both University Malaysia Kelantan in Jeli Campus and City Campus (data up to 31/05/2023)

Jeli Campus					
	Year 1	Year 2	Year 3	Year 4	**Total**
FBKT	210	201	236	170	**817**
FIAT	138	209	261	233	**841**
FSB	262	223	194	152	**831**

City Campus					
	Year 1	Year 2	Year 3	Year 4	**Total**
FPV	47	92	38	48	**225**

(Source: Syahrul, 2023)

In this study are using 2714(N) as the population size for student. The sample size of the study is calculated by using the Krejcie & Morgan, 1970 from sample size measurement formula in the figure (Figure 3.1).

The formula for determining sample size

$S = X^2NP(1-P) \div d^2(N - 1) + X^2P(1 - P)$

S = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

D = the degree of accuracy expressed as a proportion. (.05).

Source: Krejie & Morgan, 1970

Figure 3.1: Sample size measurement formula (Krejcie & Morgan, 1970)

Table 3.3: Determining a Population Sample Size (Krejcie & Morgan, 1970)

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

From the figure 3.1, showed a table on to determine the sample size based on the total population of the location in determining the specific size of the sample (Table 3.3). The selection of the sample size would be much simpler by using the sampling size table. The population size, where N was the overall population and S was the sample size, was the only piece of information needed. Therefore, according to the sampling size table, there would be 338 sample sizes for students in each population size as 2714(N) students. In this study, 338 students would complete a questionnaire. The study's target respondents are different in age, gender, race, year of students, faculty and educational qualification.

3.2 Data Collection

A survey using a questionnaire sheet was used to conduct quantitative research. The survey would be conducted from July 2023 to March 2024. In the study area of University Malaysia Kelantan, information was gathered by delivering a questionnaire form through an online platform. Participants comment would be noted and processed further for data processing employing a statistical program on a computer to process and analyze data Tables were used to illustrate the results of the statistical testing and processing. In this study, the distribution and frequency of each variable analyzed, specifically the variable demographic features of the respondents, were produced from the study findings in this analysis consisting of age, race, education, faculty, year of students, and gender, and the next three components as knowledge, attitudes, and practiced about laboratory safety based on these variables.

3.2.1 Design Questionnaire

A series of questionnaires was designed with questions that are closed-ended. In addition to closed-ended questions, which only allowed respondents to choose from the choices that were provided, open-ended questions demand that respondents respond according to their own perspectives. A series of questionnaires (Appendix A) that were sent to the intended respondents served as the study's data collection method. The questionnaires were divided into four key sections the demographics of the students, their knowledge, their attitudes, and their conduct with regard to laboratory safety.

Section one was a demographic profile with six questions that described the personality traits of those surveyed. Respondents were asked about their age, gender, race, year of students, faculty, and educational qualification.

Section two had twenty questions that ask for knowledge on laboratory safety to determine the level of knowledge of respondents toward laboratory safety. In this section, the understanding of laboratory safety was assessed. Knowledge and being aware of laboratory safety principles, procedures, and potential risks are all parts of knowledge. It involves being aware of the right way to handle and store chemicals, how to operate and maintain equipment, how to handle emergencies, what personal protective equipment (PPE) is needed, and the pertinent regulatory requirements. Through educational resources, training programs, and ongoing learning, knowledge can be acquired.

Section three had twenty questions asked on the attitude of the students towards laboratory safety including their attitude and alertness in the lab. Additionally, the conduct that they performed in the lab was assessed in this section. The attitude that participants have towards laboratory safety is referred to as their thinking and perception. It entails prioritizing safety as a crucial aspect of laboratory work and understanding its significance. Being proactive, responsible, and cautious when handling potentially hazardous products or tools are all examples of having a positive safety attitude. It also entails participating in safety conversations or efforts and swiftly reporting unsafe situations or accidents.

Section four had twenty questions on the practice of students on laboratory safety in laboratories. This part would analyze how they were directed toward the training or thing that they had already experienced. The actual use of safe behaviours and adherence to prescribed safety procedures are referred to as practise. It involves putting knowledge and a positive outlook into practise on a regular basis in the laboratory. Following standard operating procedures (SOPs), applying the necessary PPE, employing engineering controls, keeping a tidy workspace, labelling and storing chemicals correctly, and examining and maintaining equipment are all examples of safe practises. Additionally, regular audits and safety drills can assist guarantee that safe procedures are constantly followed.

For the knowledge and attitude component, a Likert scale on a scale of 1 to 5 was used to indicate whether respondents "strongly disagree," "disagree," "neutral," "agree," or "strongly agree." Next, a Likert scale with a range of 1 to 5 was used to determine whether respondents answered "Never," "Rarely," "Sometimes," "Always," or "Often" for the practices component. Respondents are limited to choose a single option from the given scale.

3.2.2 Pilot Study

A small-scale experiment or collection of observations is called a pilot study. that Dictionary.com. (2023) to determine how and whether to start a larger initiative.

If done effectively, it can help in spotting problems and suspect information that might obstruct the main data collection process. A sample size of 10% of the overall sample size should be used for the pilot study. Consequently, 33 respondents from the University Malaysia Kelantan were sampled, Jeli who had prior knowledge of laboratory safety would be used for the pre-testing of the questionnaire in this study. The Section 1 questionnaire must answer 6 questions regarding the demographics of the respondents. Answers to both closed-ended questions would be available from respondents. Respondents must answer all item statements in sections 2, 3, and 4 that had details that called for brief responses.

Cronbach's alpha analysis was used for every section to confirm the reliability of the surveys. The internal regularity, which determined how closely connected a group of objects used to be was determined by employing Cronbach's alpha. The size efficiency was evaluated using this methodology. The strong's alpha value was not required when using a one-dimensional formula. A reliability coefficient of 0.70 or more was regarded as "acceptable" in most social science study situations (Taber, 2017). Therefore, questions with a -value less than 0.70 should be eliminated.

Table 3.4: The reliability statistics for knowledge, attitude and practice

	Cronbach's Alpha
Knowledge	0.972
Attitude	0.960
Practices	0.963

The cronbach’s alpha for each section on knowledge, attitude and practices had been calculated by the SPSS that had been shown in Table 3.4. As the results shown the cronbach’s alpha for knowledge was 0.972, attitude was 0.960 and practices was 0.963. Therefore, the reliability coefficient for knowledge, attitude and practices had reached as "acceptable" because the results shown more than 0.70 in the reliability coefficient in this study.

3.3 Data Analysis

The quantitative method would be used in this study. With the use of the responder's information, each section would be summarized. It could be used to identify trends and differences among each respondent's answers to each question. In the analysis, to explain the essential elements of the survey data, a descriptive analysis would be employed. The central tendency was determined in the descriptive analysis using the mean, median, and mode.

3.3.1 Descriptive Analysis

Descriptive analysis is a type of data analysis that assists in the constructive explanation, demonstration, or summarising of information points in order for trends to become apparent that satisfy almost all the data's requirements. The most crucial phase of statistical data analysis is this one. The results of the study comprise the response distribution and statistics, a summary of the respondent's profile, and their perceived level of lab safety skills, mindsets, and behaviours.

For the mean score of level of knowledge, attitude and practice in this study, the Likert scale have been provided. The interpretation of the mean score have been done in order to know the scale of the level of knowledge, attitude and practice. The table below have been created based on previous study by (Hasbi et al, 2022)

Table 3.5: Analysis of Likert scale (Mean Score)

Mean Score	**Scale**
0.00 – 1.50	Very low
1.51 – 2.50	Low
2.51 – 3.50	Moderate
3.51 – 4.50	Good
4.51 – 5.00	Very Good

3.3.2 Inferential Analysis

The results of the normality test would determine which inferential analysis to use. This study would use analysis to compare means between groups in order to examine the variables that affected respondents' knowledge, attitude, and practices regarding laboratory safety. Evaluating classifications of subjects including sex, educational qualification, and culture among University Malaysia Kelantan students was the purpose of this test.

This test could determine gender differences in knowledge, attitude, and practices. This assessment was meant to identify the gender that influenced laboratory safety actions, but attitudes, and knowledge. It was evident that genders were related when comparing means. Table 3.6 shows the example of analysis of parametric and non-parametric to compare mean between groups. Independent t-test was used to investigate groups of subjects such as gender in the Universiti Malaysia Kelantan. This test can determine gender differences in knowledge, attitude and practices. This test is used to determine which gender influenced the dependent variable, knowledge, attitude and practices for laboratory safety. By comparing the mean between genders, it is clear that they are no related. Hence, the knowledge as an independent variable that influences the respondents' attitude and practices for laboratory safety.

Table 3.6: Parametric test and Non-Parametric Equivalent (Kim, 2014)

Comparison	**Parametric method (normal distribution assumed)**	**Nonparametric method (distribution-free method)**
Independent two groups	Independent *t*-test	Wilcoxon rank-sum test (or Mann-Whitney U test)
Correlated two groups	Paired *t*-test	Wilcoxon signed-rank test
Independent three or more groups	One-way ANOVA	Kruskal-Wallis test
Correlated three or more groups	Repeated measures one-way ANOVA	Friedman test

ANOVA is a form of statistical analysis that analyses and categorises data sets to figure out their importance. Essentially, the procedure appropriately estimates the significance of variable interactions (True Tamplin, 2023). An analysis of variance (ANOVA) is used in this research to compare means and represent the relationship between several variables.

In this study, ANOVA was applied to analyze student's knowledge, attitude, and practices toward laboratory safety.

3.4 Validation of Questionnaire

The most common method for gathering data is the questionnaire, which is an essential component of the study. The process of constructing a questionnaire involves a number of processes and offers insight into the fundamentals of both questionnaire building and validation. Questionnaire data must be able to understand the study's objectives in order to prevent incorrect interpretation or bias, lower study power, and the inability to generalise the study's findings (Boparai et al., 2019).

There are four step been used in this study to validated the questionnaire. Firstly, the step of validation had been used in this study is establish face validity which is have an experts who understand the topic in this study and read through the questionnaire. Secondly, is the step of pilot test which include small sample students as particiant. Thirdly, he surve is the analysis on cronbach's alpha which basically checks the correlation between question loading onto the same factor. Fourthly, which is the revise step if needed to revising which question have to be improve after been analysed.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Demographic analysis

The questionnaire studies from the respondent's has been collected. The respondent's age, gender, race, year of students, faculty, and academic qualification are all considered in this section. Total of 338 respondents have been participated in this survey. The frequency of age responses to the questionnaire has been calculated. The breakdown of those who participated by age in the questionnaire. According to the frequency result, 99.4% of all respondents were between the ages of 20 and 25, and 0.6% were between the ages of 26 and 35. There are no respondents who are above 35 years old in this study, because respondents are all from Bachelor students.

Next, the questionnaire were distributed to male and female among the two different campus from UMK. The frequency of gender responses to the questionnaire as shown in table 4.1. Based on the frequency result, it was found that 74.9% of the respondents overall were female students. In comparison, 25.1% of respondents are male.

Table 4.1: Distribution of the gender

Gender	Frequency
Male	85
Female	253
Total	**338**

Most students has been participants in UMK are majority Malay, where it presented 252 respondents (74.6%), followed by Chinese where it presented 40 respondents (11.8%), other ethnicities, including Sabah's Dusun where it presented 25 respondents (7.4%) and Indians where it presented 21 respondents (6.2%) from the total number of 338 students as respondents in total.

Table 4.2: Distribution of the race

Race	Frequency
Malay	252
Chinese	40
Indian	21
Others	25
Total	**338**

In this study the highest total year of students who had answering is first year students with 42%, followed by the second year students (31.4%) were the next highest percentage of respondents, third year students (15.4%) and the lowest total year of students is fourth year students (11.2%) based on the frequency result. The frequency of year of students to the questionnaire as shown in table 4.3.

Table 4.3: Distribution of the year of students

Year of students	Frequency
First year student	142
Second year student	106
Third year student	52
Fourth year student	38
Total	**338**

Furthermore, the number of replies by students are displayed in table 4.4. Most of the students were the Faculty of Earth Sciences (FSB) students accounted for 71.9%, followed by the FIAT at 12.7% with the second highest, the FBKT at 10.1%, and the lowest percent in this survey respondents is FPV at 5.3%, according to the frequency result.

Table 4.4: Distribution of the faculty

Faculty	Frequency
Faculty of Agro-Based Industry (FIAT)	43
Faculty of Bioengineering and Technology (FBKT)	34
Faculty of Earth Sciences (FSB)	243
Faculty of Veterinary Medicine (FPV)	18
Total	**338**

The frequency of academic qualification responses to the questionnaire, stated in table 4.5, is consistent with the study's results. Based on the frequency result, it was found that almost nearest were the bachelor with 42.3% and the STPM with 42%. The least follow by the matriculation or foundation were 10.9% and diploma with only 4.7%.

For academic qualification responses, the highest is Bachelor with total of respondent are 143 (42.3%) followed by STPM with 142 respondents (42%), Matriculation and Foundation with 37 respondents (10.9%) and the Diploma with 16 respondents (4.7%). According to the World Health Organisation [WHO] suggests that a fundamental element of successful IPC projects should include education and training.

Table 4.5: Distribution of education qualification

Educational Qualification	**Frequency**
Diploma	16
Matriculation/ Foundation	37
STPM	142
Bachelor	143
Total	**338**

Based on the research, the highest value for each factor from Table 4.1 to Table 4.5, had shown that mostly respondent are Malay's female students, 20 to 25 years old who are first year students studying at the FSB from Jeli campus with Bachelor as her educational qualification. Every year, students needed to go to the lab to conduct experiments, and if they were not careful, some small mishaps would unavoidably happen. The number of student mishaps in science labs is alarmingly increasing. To minimise or lessen these incidences, effective measures are needed, and one such step is to raise awareness and encourage laboratory safety practices (Vengidason et al., 2021).

4.2 Knowledge on laboratory safety

In this study, respondents' knowledge of laboratory safety was assessed based on the answers they provided towards 20 questions. Table 4.6 shows that the mean score related to the respondent's understanding of laboratory safety. The respondents' agreement with the questions about those areas and their good knowledge of laboratory safety is indicated by the mean score for each question, which ranges from 4 to 5 (Table 4.6). This practice shows proper conduct to provide a secure lab environment.

Table 4.6 indicates the knowledge of respondents towards laboratory safety. The highest agreement is on the first statement was, ‘We should wear long trousers and closed-toe shoes at all times in the laboratory’, most of respondent are strongly agree with this statement with 86.7%. According to the table, it showed that only 3.3% neutral to not anxious of the laboratory hazard. Next, the lowest agree statement for this question is about ‘We should not wearing jewellery while working in the lab’, which is almost 70.1% of total respondent 237 strongly agree about this statement. For moderately agree or neutral, there are only 10.9% of the respondent.

The respondent learned the information through various sources, including reading books, courses, social media, and training. This occurs as a result of the majority of respondents having taken science courses in the past and being knowledgeable with laboratory safety information.

The results of table 4.6 indicate that more respondents agreed than disagreed that people should scream out for help as soon as they are harmed. Their ability to act quickly in an emergency situation reflects their understanding of laboratory safety. According to the results, the least number of respondents disagree that lab coats or other protective clothing should be worn when working in the lab. This points out that even students with backgrounds in science are ignorant of the significance of personal protective equipment (PPE) for laboratory safety.

Table 4.6: Descriptive Statistics of respondent's knowledge toward laboratory safety

Statements	**Frequency (%)**					**Mean**
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	
1. We should wear long trousers and closed-toe shoes at all times in the laboratory.	2 (0.6)	1 (0.3)	11 (3.3)	31 (9.2)	293 (86.7)	4.82
2. We should wear protective clothing such as laboratory coats while working in the lab.	0 (0)	3 (0.9)	11 (3.3)	36 (10.7)	288 (85.2)	4.79

3. We should wear protective gloves safety glasses or goggles to protect our skin and eyes from potentially harmful substances.	0 (0)	2 (0.6)	16 (4.7)	51 (15.1)	269 (79.6)	4.75
4. We should not wearing jewellery while working in the lab.	4 (1.2)	5 (1.5)	37 (10.9)	55 (16.3)	237 (70.1)	4.55
5. We need to get permission before entering the laboratory.	1 (0.3)	2 (0.6)	14 (4.1)	58 (17.2)	263 (77.8)	4.62
6. We should label all containers or equipments appropriately.	1 (0.3)	1 (0.3)	16 (4.7)	49 (14.5)	271 (80.2)	4.78

7. We must not taste or intentionally sniff chemicals.	1 (0.3)	3 (0.9)	15 (4.4)	34 (10.1)	285 (84.3)	4.78
8. We should dispose of unused chemicals in designated containers.	2 (0.6)	1 (0.3)	14 (4.1)	38 (11.2)	283 (83.7)	4.80
9. We should must make sure our hair and clothes are neat while in the lab.	0 (0)	6 (1.8)	13 (3.8)	45 (13.3)	274 (81.1)	4.76
10. We should not eat, drink or apply cosmetics in the laboratory.	1 (0.3)	3 (0.9)	15 (4.4)	49 (14.5)	270 (79.9)	4.76
11. We should avoid doing nail biting in the lab.	1 (0.3)	2 (0.6)	22 (6.5)	42 (12.4)	271 (80.2)	4.76
12. We must not use mouth	4 (1.2)	3 (0.9)	16 (4.7)	52 (15.4)	263 (77.8)	4.77

suction for pipetting or starting a siphon.						
13. We should be alert the nearest location of fire extinguishers, eyewash stations, and laboratory safety shower.	1 (0.3)	2 (0.6)	15 (4.4)	48 (14.2)	272 (80.5)	4.77
14. We have to be aware of the emergency exit route.	1 (0.3)	2 (0.6)	11 (3.3)	48 (14.2)	276 (81.7)	4.81
15. We should yell out immediately and as loud as to get help if injured.	4 (1.2)	10 (3.0)	29 (8.6)	77 (22.8)	218 (64.5)	4.59
16. We should notify and document all	0 (0)	6 (1.8)	21 (6.2)	48 (14.2)	263 (77.8)	4.78

accidents and dangerous occurrences.						
17. If the laboratory work carried out is high risk, we should not work alone.	2 (0.6)	4 (1.2)	18 (5.3)	50 (14.8)	264 (78.1)	4.76
18. We should put up warning signs when we are using dangerous materials, or dangerous machinery in the laboratory.	0 (0)	2 (0.6)	19 (5.6)	47 (13.9)	270 (79.9)	4.78
19. We must use equipment for its assigned function.	1 (0.3)	3 (0.9)	18 (5.3)	56 (16.6)	260 (76.9)	4.77
20. We always ensure that chemical	0 (0)	3 (0.9)	15 (4.4)	47 (13.9)	273 (80.8)	4.82

containers are closed.						

Based on the result, it can be seen that most respondent are totally have the knowledge of laboratory safety, which showed that respondents are exposed to the knowledge towards facing laboratory hazard. Based on the 4.7, the mean score of knowledge towards students is 4.71, which indicates that respondents have a very good knowledge. According to research, the process of producing knowledge about student learning from the 39 evaluation of student learning assessments is intricate and requires expert analysis, subject-matter knowledge, and more intense group discussions and debates in order to produce information that can be put to use (Spencer-Johnson, 2018).

Table 4.7: Total mean score of knowledge

	Knowledge
N	338
Mean	4.71 (Very Good)
Standard Deviation	0.514

4.3 Attitude on laboratory safety

The third section analysed the respondents' attitude towards laboratory safety through the analysis of their responses to 20 questions. Table 4.8 below shows that the mean score for the respondent's attitude towards laboratory safety is calculated.

Table 4.8 displays the respondents' attitudes about the importance of following laboratory safety precautions when working in the labs. Each of the questions had a minimal mean score of 4.0, which suggests that respondents usually had positive attitudes on laboratory safety. Thus, there may be a lower chance of accidents in the laboratory as a result of this.

Table 4.8 indicates the attitude of respondents towards laboratory safety. There are two highest agreement is on the eight and fourteen statement were, ‘Dispose of unused chemicals in appropriate containers’ and ‘Know emergency exit routes’, majority of respondent are strongly agree with this statement with 84%. Next, the lowest agree statement for this question is about ‘Wearing jewellery while working in the lab can provide several safety risks ’, which is almost 69.5% of total respondent 235 strongly agree about this statement. For moderately agree or neutral, there are only 8.3% of the respondent.

Chemical containers should never be left open when not in use, according to the majority of responders with the mean value of 4.82. Besides, with a mean score of 4.62, more than half of the respondents agreed that only people with authorization should enter or work in the laboratory. In order to keep anyone from learning about a laboratory accident, it is preferable to get authorization before visiting the lab.

Table 4.8: Descriptive Statistics of respondent’s attitude toward laboratory safety

Statements	Frequency (%)					Mean
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
1. In the lab, long trousers	0 (0)	1 (0.3)	4 (1.2)	51 (15.1)	282 (83.4)	4.82

and footwear that completely enclose the top of the foot are required at all times.						
2. Protective clothing such as laboratory coats must be worn while performing or working in the laboratory.	0 (0)	2 (0.6)	5 (1.5)	54 (16)	277 (82)	4.79
3. Wear protective gloves safety glasses or goggles to protect our skin and eyes from potentially harmful substances.	2 (0.6)	0 (0)	8 (2.4)	60 (17.8)	268 (79.3)	4.75

4. Wearing jewellery while working in the lab can provide several safety risks.	3 (0.9)	6 (1.8)	28 (8.3)	66 (19.5)	235 (69.5)	4.55
5. Only authorised persons may enter and/or work in the laboratory.	3 (0.9)	5 (1.5)	20 (5.9)	62 (18.3)	248 (73.4)	4.62
6. All containers must have appropriate labels.	0 (0)	1 (0.3)	5 (1.5)	61 (18)	271 (80.2)	4.78
7. Do not taste or intentionally sniff chemicals.	0 (0)	3 (0.9)	7 (2.1)	50 (14.8)	278 (82.2)	4.78
8. Dispose of unused chemicals in appropriate containers.	1 (0.3)	1 (0.3)	9 (2.7)	43 (12.7)	284 (84)	4.80

9. Keeping hair and clothes tidy while in the laboratory.	1 (0.3)	1 (0.3)	7 (2.1)	59 (17.5)	270 (79.9)	4.76
10. Never consume and/or store food or beverages or apply cosmetics in the laboratory.	2 (0.6)	2 (0.6)	10 (3)	47 (13.9)	277 (82)	4.76
11. Avoid doing nail biting in the lab.	1 (0.3)	3 (0.9)	9 (2.7)	49 (14.5)	276 (81.7)	4.76
12. Do not use mouth suction for pipetting or starting a siphon.	2 (0.6)	2 (0.6)	7 (2.1)	49 (14.5)	278 (82.2)	4.77
13. Knowing the nearest locations of safety equipment such as laboratory safety showers,	0 (0)	2 (0.6)	5 (1.5)	63 (18.6)	268 (79.3)	4.77

eyewash stations, and fire extinguishers.						
14. Know emergency exit routes.	0 (0)	2 (0.6)	6 (1.8)	46 (13.6)	284 (84)	4.81
15. Yell out immediately and as loud as to get help if injured.	2 (0.6)	5 (1.5)	21 (6.2)	73 (21.6)	237 (70.1)	4.59
16. All accidents and dangerous occurrences must be reported and recorded.	0 (0)	2 (0.6)	9 (2.7)	51 (15.1)	276 (81.7)	4.78
17. Do not work alone in a laboratory if the laboratory work being conducted are hazardous.	1 (0.3)	3 (0.9)	8 (2.4)	53 (15.7)	273 (80.8)	4.76
18. Post-warning signs are a must when using hazardous	0 (0)	2 (0.6)	9 (2.7)	50 (14.8)	277 (82)	4.78

materials or hazardous machinery in the laboratory.						
19. Use equipment only for its designated purpose.	0 (0)	1 (0.3)	9 (2.7)	56 (16.6)	272 (80.5)	4.77
20. Chemical containers should never be left open while not been using.	0 (0)	1 (0.3)	4 (1.2)	50 (14.8)	283 (83.7)	4.82

Based on the result, it shows that the attitude of students in UMK toward the attitude during laboratory experiment was high. Therefore, it showed that respondents are exposed to the good attitude while entering laboratory or doing experiment on laboratory. Based on the table 4.9, the mean score of attitude towards students is 4.75, which indicates that respondents have a very good attitude. The way the teacher conducted laboratory research could be the cause of this. Students' behaviour is influenced and shaped by the teacher's admonitions, the rules that are important to them, and the behaviours that they observe. For instance, if the instructor brings up the topic more frequently, the students' focus can be drawn to that behaviour. Similar to this, if a teacher conducts laboratory experiments without using safety gear like gloves or lab glasses, pupils can view this behaviour as typical and not as a weakness (Caymaz, 2021).

Table 4.9: Total mean score of attitude

	Attitude
N	338
Mean	4.75 (Very Good)
Standard Deviation	0.419

4.4 Practice on laboratory safety

Twenty questions were asked to each respondents in this forth section, and the answers were used to examine laboratory safety practices (Table 4.10). The average score for all questions falls between 4 and 5, suggesting that students are following good procedures when it comes to laboratory safety.

According to those who answered "rarely" and "often," the majority of them used to put off wearing jewelery while working in the lab. As a result, it proves that they follow procedures for lab safety while working.

According on table 4.10, the data on practice on laboratory safety have been collected. The first statement was, ‘I always wear long trousers and closed-toe shoes in the laboratory’, most of respondent are Often with this statement is 86.7%. The table 4.10 had showed that 0.3% Never and Rarely with this statement and have 3.3% of respondent that are Sometimes about laboratory practices.

With a mean score of 4.82, most respondents stated that they always wear long trousers and closed-toe shoes in the laboratory. Furthermore, with a mean score of 4.65, over 50% of the participants concurred that wearing safety glasses, goggles, or gloves can shield the skin and eyes from potentially hazardous substances.

Table 4.10: Descriptive Statistics of respondent's practice toward laboratory safety

Statements	Frequency (%)					Mean
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
1. I always wear long trousers and closed-toe shoes in the laboratory.	1 (0.3)	1 (0.3)	11 (3.3)	32 (9.5)	293 (86.7)	4.82
2. I wear protective clothing such as laboratory coats throughout my work in the lab.	0 (0)	2 (0.6)	16 (4.7)	48 (14.2)	272 (80.5)	4.79
3. I will wear protective gloves safety glasses or goggles to protect my skin and eyes from potentially	3 (0.9)	3 (0.9)	24 (7.1)	49 (14.5)	259 (76.6)	4.75

harmful substances.						
4. I put off the jewellery while working in the lab.	12 (3.6)	8 (2.4)	29 (8.6)	55 (16.3)	234 (69.2)	4.55
5. I obtained authorization or permission before entering the laboratory.	1 (0.3)	3 (0.9)	11 (3.3)	46 (13.6)	277 (82)	4.62
6. I label all containers or equipment appropriately.	0 (0)	3 (0.9)	14 (4.1)	44 (13)	277 (82)	4.78
7. I do not taste or intentionally sniff chemicals.	5 (1.5)	4 (1.2)	14 (4.1)	45 (13.3)	270 (79.9)	4.78
8. I dispose of the chemical waste according to a correct disposal practice.	1 (0.3)	2 (0.6)	14 (4.1)	49 (14.5)	272 (80.5)	4.80

9. I tie up my long hair and fasten loose garments to prevent tangles or possible capture.	0 (0)	3 (0.9)	16 (4.7)	43 (12.7)	276 (81.7)	4.76
10. I do not eat, drink or apply cosmetics in the laboratory.	6 (1.8)	2 ()	19 (5.6)	34 (10.1)	277 (82)	4.76
11. I do not bite my nails while in the lab.	4 (1.2)	2 (0.6)	14 (4.1)	41 (12.1)	277 (82)	4.76
12. I do not use mouth suction for pipetting or starting a siphon.	3 (0.9)	2 (0.6)	14 (4.1)	33 (9.8)	286 (84.6)	4.77
13. I am aware of the nearest locations of the closest eyewash stations, fire extinguishers,	0 (0)	4 (1.2)	15 (4.4)	48 (14.2)	271 (80.2)	4.77

and lab safety showers.						
14. I know the emergency exits route.	1 (0.3)	4 (1.2)	12 (3.6)	44 (13)	277 (82)	4.81
15. I yell out immediately and as loud as to get help when I am injured.	7 (2.1)	7 (2.1)	25 (7.4)	58 (17.2)	241 (71.3)	4.59
16. I notify and document all accidents and dangerous occurrences.	1 (0.3)	7 (2.1)	18 (5.3)	49 (14.5)	263 (77.8)	4.78
17. I do not work alone if the laboratory work being performed are risky.	0 (0)	3 (0.9)	18 (5.3)	45 (13.3)	272 (80.5)	4.76
18. I put up warning signs when using dangerous	1 (0.3)	7 (2.1)	20 (5.9)	38 (11.2)	272 (80.5)	4.78

substances or dangerous machinery in the laboratory.						
19. I utilize equipment for its intended function correctly.	0 (0)	1 (0.3)	15 (4.4)	48 (14.2)	274 (81.1)	4.77
20. I always close the containers of chemicals.	0 (0)	2 (0.6)	13 (3.8)	41 (12.1)	282 (83.4)	4.82

Based on the result, it shows that majority respondent are having some practices of laboratory safety, which showed that respondents are exposed to the practices towards laboratory training. Based on the 4.11, the mean score of practices towards students is 4.71, which indicates that respondents have a very good practices. Joining training event on laboratory safety could improve the practices in lab and could avoid unwanted accidents. Strengthening safety intervention methods in the laboratory requires programmes in safety knowledge and training (Sukri et al., 2023).

Table 4.11: Total mean score of practice

	Practice
N	338
Mean	4.71 (Very Good)
Standard Deviation	0.509

4.5 Relationship between student's Knowledge, Attitude and Practices toward Laboratory Safety

A one-way ANOVA was conducted to compare the knowledge, attitude and practice of age on laboratory safety in the age range of 20–25, 26–35, 36–45, 46–55, 56–65, 66–75, and older. Based on Table 4.12, age was taken into account while determining their importance in relation to University Malaysia Kelantan students' knowledge, attitudes, and laboratory safety actions. According to Table 4.12, there was a non-significant on understanding, attitudes, and action of age on laboratory safety at the $p > 0.05$ level the three condition [F= (0.632, P (0.427) > $\alpha = 0.05$). The null hypothesis, according to which there is a variation in laboratory safety among age groups, is accepted because the p-value is greater than p= 0.05. The mean for knowledge, attitude and practice of age 20-25 years old is all above 4.70 which is higher than 26-35 years old. The majority of the respondents were aged between 20-25 years old. These results may be since the respondents from the Jeli campus and City campus have a background in science subjects and all were closely understanding the laboratory safety that related to this study.

Table 4.12: ANOVA test of students' knowledge, attitude and practices based on age.

	Age	**N**	**Mean**	**F**	**Sig.**
Knowledge	20-25 years old	336	4.71	0.632	0.427
	26-35 years old	2	5.00		
Attitude	20-25 years old	336	4.75	0.706	0.401
	26-35 years old	2	5.00		
Practices	20-25 years old	336	4.71	0.644	0.423
	26-35 years old	2	5.00		

The differences in overall laboratory safety were analysed according to each gender's knowledge, attitude, and practices. Male and female UMK students' knowledge, attitudes, and practices regarding laboratory safety were compared using an independent t-test (Table 4.13). Based on the results in Table 4.13, the highest mean gender were the respondents from females on knowledge and attitude. The mean for knowledge are [F=4.73, p = 0.230] and the mean of attitudes [F=4.76, p = 0.283] followed by the highest mean from male on practices [F=4.72, p = 0.774]. The respondents were expected to be aware of the laboratory safety as they must be giving attention today. The studies of the knowledge about laboratory safety managed to stimulate the respondents' alert and awareness of it. Besides, Table 4.13 shows that gender was not significant on the respondent's knowledge, attitude, and practice as the p-value was more extensive than 0.05, as each are p = 0.230, p= 0.283 and p= 0.774.

Table 4.13: Students' knowledge, attitude and practices based on gender.

	Gender	N	Mean	F	t-test	Sig.
Knowledge	Female	253	4.73	1.446	0.913	0.230
	Male	85	4.67			
Attitude	Female	253	4.76	1.157	0.815	0.283
	Male	85	4.72			
Practices	Female	253	4.71	0.082	-0.183	0.774
	Male	85	4.72			

Next, a one-way Analysis of Variance (ANOVA) was conducted to compare the respondents' knowledge, attitude and practices towards the laboratory safety from each race (Table 4.14). The significance level for this study was set at p = 0.05. The results presented that all races with the knowledge, attitude and practices towards the laboratory safety were not significant with all values above than p = 0.05 as knowledge with p= 0.642, attitude p= 0.864 and practices p = 0.300 were non- significant that had shown on Table 4.14. According to Table 4.14's result, the knowledge and practices with the highest mean were the respondents from Indian that F=0.560 and p = 0.642 for knowledge and F=1.225 with p = 0.3 for the practices. The respondents from malay and chinese show the least mean knowledge and attitude as the value mean from M= 4.70 to M= 4.75.

Table 4.14 ANOVA of students' knowledge, attitude and practices based on race.

	Race	N	Mean	F	Sig.
Knowledge	Malay	252	4.70	0.560	0.642
	Chinese	40	4.71		

	Indian	21	4.83		
	Others	25	4.77		
Attitude	Malay	252	4.74	0.247	0.864
	Chinese	40	4.75		
	Indian	21	4.79		
	Others	25	4.81		
Practices	Malay	252	4.69	1.225	0.300
	Chinese	40	4.76		
	Indian	21	4.90		
	Others	25	4.67		

To contrast the first, second, third, and fourth years of theirs knowledge, attitudes, and practices regarding laboratory safety, a one-way ANOVA was carried out. The students' factor year was utilised to assess their applicability to University Malaysia Kelantan's laboratory safety actions, attitudes, and knowledge based on Table 4.15. Table 4.15 shows that knowledge, attitude, and practice the year of students on laboratory safety were all non-significant at the p > 0.05 level for all three conditions [F= (2.355, P (0.072) > = 0.05] for knowledge, followed by the attitude [F= (1.838, P (0.140) > = 0.05] and practices with the value of F= 1.017 and P=0.385. As the p-value is higher than p=0.05, the null hypothesis is accepted, indicating that there is a difference in laboratory safety between different student year groups. The mean for students' knowledge, attitudes, and practices ranges from first to fourth year, with all values above M=4.60. First and second-year students made up more than half of the responders. The fact that the individuals were chosen from the Jeli and City campuses may help to explain these results, all had prior experience in science and were well-versed in the topic of laboratory safety prior to studying in University Malaysia Kelantan. The respondents were expected to be year four students as the highest as they are the last year students at each faculty. However, the studies have shown that total first year students are the most while others are only 52 or 38 for year 3 and year 4 students who are involved to collect the knowledge, attitude and practice towards laboratory safety.

Table 4.15: ANOVA of students' knowledge, attitude and practices based on year of students.

	Year of students	**N**	**Mean**	**F**	**Sig.**
Knowledge	First year student	142	4.78	2.355	0.072
	Second year student	106	4.62		
	Third year student	52	4.66		
	Fourth year student	38	4.78		
Attitude	First year student	142	4.80	1.839	0.140
	Second year student	106	4.68		
	Third year student	52	4.74		
	Fourth year student	38	4.79		
Practices	First year student	142	4.76	1.017	0.385
	Second year student	106	4.65		
	Third year student	52	4.69		
	Fourth year student	38	4.74		

The respondents' knowledge, attitudes, and practices about laboratory safety from various faculties were contrasted using an ANOVA conducted in one direction (Table 4.16). The significance level for this investigation was chosen at p = 0.05, as was previously stated. According to the results, attitudes were significant at p = 0.038, while knowledge and practices regarding laboratory safety were not significant for any faculty member with a value above p = 0.05. Knowledge was significant at p = 0.132, and practices at p = 0.314. The highest mean knowledge and attitude from four faculties from two different campuses are FSB and FPV as M=4.72 and M=4.76 for student's from FSB, M=4.92 and M=4.96 from FPV. Next, the lowest mean for knowledge, attitude and practices was FIAT with the mean M=4.59 for knowledge, M=4.62 for attitude and M=4.66 for practices (Table 4.16).

Table 4.16: ANOVA of students' knowledge, attitude and practices based on faculties.

	Faculties	**N**	**Mean**	**F**	**Sig.**
Knowledge	FBKT	34	4.70	1.885	0.132
	FIAT	43	4.59		
	FSB	243	4.72		
	FPV	18	4.92		
Attitude	FBKT	34	4.74	2.834	0.038
	FIAT	43	4.62		
	FSB	243	4.76		
	FPV	18	4.96		
Practices	FBKT	34	4.77	1.189	0.314
	FIAT	43	4.66		
	FSB	243	4.70		
	FPV	18	4.91		

To investigate the practices, attitudes, and knowledge of various educational qualification regarding laboratory safety in Diploma, STPM, Bachelor, Matriculation, and Foundation programmes, a one-way ANOVA was carried out. The factor educational qualification was utilised to determine its relevance regarding the knowledge, attitude, and laboratory safety procedures of students at University Malaysia Kelantan, based on Table 4.17. As indicated by Table 4.17, all three conditions for knowledge, attitude, and practice of age on laboratory safety were found to be non-significant at the $p > 0.05$ level. Knowledge was found to be [F= (2.284, P (0.079) > = 0.05], followed by attitude and practices [F= (2.188, P (0.089) > = 0.05] for attitude and practices. The highest mean for education level according the knowledge, attitude and practice towards Diploma, STPM, Bachelor and Matriculation or Foundation in two selected campus was Diploma with the mean M=4.88, M=4.91 and M=4.93 and the lowest mean for was Bachelor with the mean M=4.63, M=4.71 and M=4.64 (Table 4.17). However, these results were not accurate as the number of respondents for age 26 to 35 years old was only 2 respondents based on the table 4.12. This finding clearly shows that the number of respondents aged between 20-25 years recorded have the highest number of respondents compared to those aged 26-35.

Table 4.17: ANOVA of students' knowledge, attitude and practices based on academic qualification.

	Academic Qualification	**N**	**Mean**	**F**	**Sig.**
Knowledge	Diploma	16	4.88	2.284	0.079
	STPM	142	4.77		
	Bachelor	143	4.63		
	Matriculation/Foundation	37	4.71		

Attitude	Diploma	16	4.91	1.624	0.184
	STPM	142	4.76		
	Bachelor	143	4.71		
	Matriculation/Foundation	37	4.81		
Practices	Diploma	16	4.93	2.188	0.089
	STPM	142	4.75		
	Bachelor	143	4.64		
	Matriculation/Foundation	37	4.74		

As far as research on KAP towards lab safety among students is concerned, this is the best that can be said. The majority of participants claimed to be aware of laboratory safety, but their understanding of the hazards present in the lab was inadequate. The majority of participants revealed a surprising lack of experience with particular to industries training, despite their favourable attitudes and adoption of best practices. We also saw that an individual's knowledge, attitude, and adoption of best practices were largely influenced by their educational attainment. Experience and educational qualification were found to be the main significant elements in determining the overall KAP score of the data, even if age and educational qualification of an individual had a significant influence in adhering to best practices. Therefore, in order to close the knowledge and attitude gap among different medical laboratory staff members and guarantee better preparedness in the future, provide additional training on outside activities with enterprises that have labs.

Results also indicate that age, occupation, and educational attainment all had an impact on how easily people could access these seminars, underscoring the necessity for the Ministry of Health to restructure its current policy on educating medical laboratory staff. Our study has a number of advantages and disadvantages. This study's merit is that it particularly addresses a significant public health issue in light of the recent COVID-19 pandemic epidemic (Zhu et al., 2020). This study focuses on the KAP level of students who regularly attend laboratories and are required to complete final year projects as part of their research. This study's strong representation of a range of age groups and genders may be another one of its strengths. Furthermore, gathering data from a variety of pupils makes our findings and results more broadly applicable.

On the other hand, recall bias and misclassification might be problems with questionnaire-based data gathering techniques. Furthermore, response rates differed throughout students.

Table 4.18: A correlation the relationship between knowledge, attitude, and practice among the study participants (n=338).

Mean (M)	Knowledge	Attitude	Practice
Knowledge			
r	1	0.722**	0.634**
Sig.		<0.001	<0.001
Attitude			
r	0.722**	1	1
Sig.	<0.001		
Practice			
r	0.634**	0.649**	1
Sig.	<0.001	<0.001	

The correlation between knowledge, attitudes and practices was examined. The overall correlation between knowledge, attitudes and practices was strong correlated with each other. The correlation coefficient was between r = 0.634 to r = 1 (Table 4.18).

The correlation between knowledge and attitude show high correlation ($r = 0.722$, $N = 338$, $p < 0.05$). This study shows that the respondents were aware of the laboratory safety while in experiment. Therefore, the respondents realize that laboratory hazard will occur accident if take it for granted or did not used PPE. Hence affect their health. This study's results were acceptable, as a similar study has been conducted by Caymaz, 2021, that the laboratory safety is the process of identifying potential hazards and mishaps during research, putting safety measures in place to prevent them, and using scientific methods to solve any issues that may arise. Furthermore, adhering to particular guidelines in the lab to safeguard subjects and the environment while doing research and making the best use of the equipment are also aspects of laboratory safety. When safety precautions are not followed, laboratory mishaps are unavoidable. These mishaps could cause minor injuries or perhaps highly significant outcomes like fatalities. The primary reasons for mishaps include inadequate laboratory design, inappropriate material and equipment storage, and the lack of or poor usage of safety gear.

This study's results were acceptable, as similar research has been conducted by the University of Putra Malaysia, where they measured the knowledge, attitudes and practices among laboratory worker towards occupational safety and. From the study, they identified that laboratory staff' knowledge, attitudes, and practices about safety precautions be evaluated in relation to their regular job functions. Based on the findings, the researcher stated that knowledge was influenced due to their jobs is relatively low (Almutairi et al., 2020).

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In order for students to feel comfortable in the laboratory, it is crucial that they apply their knowledge of laboratory safety to the academic laboratory setting. The laboratory is a location where students can go seek out the results they need for an experiment, but it can also be very dangerous if they proceed with the experiment without understanding laboratory safety. Thus, it is important that people who work in laboratories get the appropriate knowledge, attitudes, and practices regarding laboratory safety.

The knowledge, attitudes, and practices of students with the laboratory safety have been investigated in this study at the UMK City and Jeli campuses. The frequency of respondents and the mean score for each question are displayed by descriptive statistics, which help identify the knowledge, attitude, and practice.

The results of the data collection showed that students at the UMK Jeli Campus and City Campus typically had good laboratory safety knowledge, attitudes, and practices. Furthermore, based on the findings, it can be said that in order to continue with excellent attitudes and practices in the lab, they need to learn more about laboratory safety. Thus, the study's initial goals have been achieved.

The second objective, which suggests to evaluate the relationship between students' knowledge, attitude, and practices towards the laboratory safety has been achieved. Therefore, based on the results, it has been shown that all students with the background of science should make sure at all of the laboratories at the UMK Jeli campus and the city campus, every faculty already has policies and guidelines that every staff member and student who work in the laboratories have to stick by. Students will learn more about laboratory safety and be better behaved as a result of these safety rules and regulations.

This information can be used to implement a variety of safety measures that will help prevent accidents in the laboratory by raising awareness of safety hazards. However, the most crucial element in preserving laboratory safety is the knowledge, attitudes, and actions of the individuals themselves. Therefore, those who handle chemicals, such as students and staff, need to be especially aware of how important laboratory safety is.

5.2 Recommendation

Everyone has a responsibility to ensure laboratory safety. It calls for the right safety gear, as well as knowledge, attitudes, and behaviours related to laboratory safety, such as understanding how to handle any potentially harmful hazards that may arise during an experiment. A number of recommendations may be required to increase awareness of the importance of laboratory safety based on the survey's results.

The survey form should be passed on to the campuses of Uitm and UMS, two more universities, as the first thing to be improved. This means that the results of laboratory safety protocols may be established for every student at different universities. Participation from staff is required when filling out the survey. As a result, every science student as well as staff members working in various university laboratories can have their level of understanding and practice regarding laboratory safety evaluated.

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LAMPIRAN A

APPENDIX A

FACULTY OF EARTH SCIENCE

BACHELOR DEGREE OF APPLIED SCIENCE

(SUSTAINABLE SCIENCE)

QUESTIONNAIRE ON ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE ON LABORATORY SAFETY IN UNIVERSITY MALAYSIA KELANTAN

Disclaimer:

I am the student of Universiti Malaysia Kelantan (UMK) and presently doing a research on 'Knowledge, Attitude and Practice regarding Laboratory Safety in Tertiary School Laboratories'. Your responses will be anonymous and will never be linked to the university or to you personally. I will not use your name or any information that would allow you to be identified in any presentation or published work related to the research. Kindly fill in the questionnaire below and assure that the data you generated shall be kept confidential and for research purpose only. I appreciate your time and generosity. Thank you for your cooperation. If you have any question or require more information about the study itself, please do not hesitate to contact me, Joey Teoh Kim Lu (014-9135991).

BAHAGIAN 1: DEMOGRAFIK

SECTION 1: DEMOGRAPHIC

Arahan: Sila tandakan (√) pada petak yang disediakan di bawah.

Instruction: Please tick (√) in the box provided below.

1. Umur / *Age*:

☐ 20-25 tahun / *years old* ☐ 26-35 tahun / *years old*
☐ 34-45 tahun / *years old* ☐ 46-55 tahun / *years old*
☐ 56-65 tahun / *years old* ☐ 66-75 tahun ke atas / *years old and above*

2. Jantina / *Gender*:

☐ Perempuan / *Female* ☐ Lelaki / *Male*

3. Bangsa / *Race*:

☐ Melayu /*Malay* ☐ Cina /*Chinese* ☐ India /*Indian* ☐ Lain /*Others*

4. Pelajar Tahun / *Year of students*:

☐ Pelajar tahun 1 / *1st year student* ☐ Pelajar tahun 2 / *2nd year student*
☐ Pelajar tahun 3 / *3rd year student* ☐ Pelajar tahun 4 / *4th year student*

5. Fakulti / *Faculty*:

☐ Faculty of Bioengineering and Technology (FBKT)

☐ Faculty of Agro-Based Industry (FIAT)

☐ Faculty of Earth Sciences (FSB)

☐ Faculty of Veterinary Medicine (FPV)

6. Kelayakan akademik tertinggi / *Highest achieve academic qualification*:

☐ Diploma ☐ STPM
☐ Sarjana Muda /*Bachelor* ☐ Matrikulasi /*Matriculation* /Asasi /*Foundation*

Arahan: Bagi setiap pernyataan di bawah, sila nyatakan sejauh mana tahap kefahaman anda dengan tandakan (√) dalam kotak yang berkenaan (1-5).

Instruction: *For each statement below, please indicate the extent of your level of understanding by tick (√) in the appropriate box (1-5).*

Sangat tidak setuju / *Strongly disagree*	**Tidak bersetuju/ *Disagree***	**Neutral / *Neutral***	**Setuju / *Agree***	**Sangat bersetuju / *Strongly agree***
1	2	3	4	5

BAHAGIAN 2: PENGETAHUAN MENGENAI KESELAMATAN MAKMAL

SECTION 2: KNOWLEDGE ON LABORATORY SAFETY

	1	**2**	**3**	**4**	**5**
1. Kita hendaklah memakai seluar panjang dan kasut tertutup sepanjang masa di dalam makmal. *We should wear long trousers and closed-toe shoes at all times in the laboratory.*					
2. Kita hendaklah memakai pakaian pelindung seperti kot makmal semasa memasuki makmal. *We should wear protective clothing such as laboratory coats when entering the lab.*					
3. Kita harus memakai sarung tangan pelindung cermin mata keselamatan atau gogal untuk melindungi kulit dan mata kita daripada bahan yang berpotensi berbahaya. *We should wear protective gloves safety glasses or goggles to protect our skin and eyes from potentially harmful substances.*					
4. Kita harus mengelak daripada memakai barang kemas semasa bekerja di makmal. *We should avoid wearing jewellery while working in the lab.*					
5. Kita tidak boleh memasuki makmal tanpa kebenaran. *We must not enter the laboratory without authorization.*					

6. Kita harus melabel semua bekas dengan sewajarnya. *We should label all containers appropriately.*					
7. Kita tidak boleh merasa atau sengaja menghidu bahan kimia. *We must not taste or intentionally sniff chemicals.*					
8. Kita tidak seharusnya mencurahkan bahan kimia ke dalam longkang dan harus membuangnya mengikut polisi pengumpulan dan pelupusan sampah. *We should not pour chemicals down drains and should dispose of them according to trash collection and disposal policies.*					
9. Kita harus menarik rambut panjang dan mengikat pakaian yang longgar untuk mengelakkan kusut atau kemungkinan ditangkap. *We should pull back long hair and fasten loose garments to prevent tangles or possible capture.*					
10. Kita tidak boleh makan, minum atau menggunakan kosmetik di dalam makmal. *We should not eat, drink or apply cosmetics in the laboratory.*					
11. Kita harus mengelak daripada menggigit kuku di makmal. *We should avoid doing nail biting in the lab.*					
12. Kita tidak boleh menggunakan sedutan mulut untuk paip atau memulakan sifon. *We must not use mouth suction for pipetting or starting a siphon.*					
13. Kita harus berwaspada di mana letaknya alat pemadam api, stesen cuci mata, dan pancuran keselamatan makmal terdekat. *We should be alert to where the closest fire extinguishers, eyewash stations, and laboratory safety showers are located.*					

14. Kita harus berwaspada tentang pintu keluar kecemasan. *We have to be aware of emergency exits.*					
15. Kita harus menjerit dengan segera dan sekuat-kuatnya untuk mendapatkan bantuan jika cedera. *We should yell out immediately and as loud as to get help if injured.*					
16. Kita harus memaklumkan dan mendokumentasikan semua kemalangan dan kejadian berbahaya. *We should notify and document all accidents and dangerous occurrences.*					
17. Jika operasi makmal yang dijalankan berisiko, kita tidak sepatutnya bekerja sendiri di sana. *If the laboratory operations being performed are risky, we should not work by ourselves there.*					
18. Kita harus meletakkan tanda amaran apabila bahaya luar biasa, bahan berbahaya, jentera berbahaya, atau keadaan luar biasa lain hadir. *We should put up warning signs when exceptional dangers, dangerous substances, hazardous machinery, or other unusual circumstances are present.*					
19. Kita harus menggunakan peralatan untuk fungsi yang dimaksudkan. *We ought to utilize equipment for its intended function.*					
20. Kita tidak seharusnya membiarkan bekas bahan kimia terbuka. *We should not leave containers of chemicals open.*					

Arahan: Bagi setiap pernyataan di bawah, sila nyatakan sejauh mana tahap kefahaman anda dengan tandakan (√) dalam kotak yang berkenaan (1-5).

Instruction: *For each statement below, please indicate the extent of your level of understanding by tick (√) in the appropriate box (1-5).*

Sangat tidak setuju / ***Strongly disagree***	**Tidak bersetuju /** ***Disagree***	**Neutral /** ***Neutral***	**Setuju /** ***Agree***	**Sangat bersetuju /** ***Strongly agree***
1	2	3	4	5

BAHAGIAN 3: SIKAP KESELAMATAN MAKMAL

SECTION 3: ATTITUDE OF LABORATORY SAFETY

	1	**2**	**3**	**4**	**5**
1. Di makmal, seluar panjang dan kasut yang menutup sepenuhnya bahagian atas kaki diperlukan pada setiap masa. *In the lab, long trousers and footwear that completely enclose the top of the foot are required at all times.*					
2. Pakaian pelindung seperti kot makmal wajib dipakai semasa memasuki makmal. *Protective clothing such as laboratory coats is required wear when entering the lab.*					
3. Pakai sarung tangan pelindung cermin mata keselamatan atau gogal untuk melindungi kulit dan mata kita daripada bahan yang berpotensi berbahaya. *Wear protective gloves safety glasses or goggles to protect our skin and eyes from potentially harmful substances.*					
4. Memakai barang kemas semasa bekerja di makmal boleh memberikan beberapa risiko keselamatan. *Wearing jewellery while working in the lab can provide several safety risks.*					
5. Hanya orang yang diberi kuasa boleh masuk dan/atau bekerja di makmal.					

Only authorised persons may enter and/or work in the laboratory.					
6. Semua bekas mesti mempunyai label yang sesuai. *All containers must have appropriate labels.*					
7. Jangan rasa atau sengaja menghidu bahan kimia. *Do not taste or intentionally sniff chemicals.*					
8. Jangan tuangkan bahan kimia ke dalam longkang dan hendaklah membuangnya mengikut polisi pengumpulan dan pelupusan sampah. *Do not pour chemicals down drains and should dispose of them according to trash collection and disposal policies.*					
9. Tarik ke belakang rambut panjang dan kencangkan pakaian longgar untuk mengelakkan kusut atau kemungkinan ditangkap. *Pull back long hair and fasten loose garments to prevent tangles or possible capture.*					
10. Jangan sekali-kali mengambil dan/atau menyimpan makanan atau minuman atau menggunakan kosmetik di dalam makmal. *Never consume and/or store food or beverages or apply cosmetics in the laboratory.*					
11. Elakkan melakukan menggigit kuku di makmal. *Avoid doing nail biting in the lab.*					
12. Jangan gunakan sedutan mulut untuk paip atau memulakan sifon. *Do not use mouth suction for pipetting or starting a siphon.*					
13. Ketahui lokasi terdekat peralatan keselamatan seperti pancuran mandian keselamatan makmal, stesen cuci mata, dan alat pemadam api. *Know the nearest locations of safety equipment such as laboratory safety showers, eyewash stations, and fire extinguishers.*					

14. Ketahui laluan keluar kecemasan. *Know emergency exit routes.*					
15. Jerit dengan segera dan sekuat-kuatnya untuk mendapatkan bantuan jika cedera. *Yell out immediately and as loud as to get help if injured.*					
16. Semua kemalangan dan kejadian berbahaya mesti dilaporkan dan direkodkan. *All accidents and dangerous occurrences must be reported and recorded.*					
17. Jangan bekerja sendirian di makmal jika prosedur yang dijalankan adalah berbahaya. *Do not work alone in a laboratory if the procedures being conducted are hazardous.*					
18. Tanda amaran pasca adalah satu kemestian apabila bahaya luar biasa, bahan berbahaya, peralatan berbahaya atau keadaan khas lain wujud. *Post-warning signs are a must when unusual hazards, hazardous materials, hazardous equipment, or other special conditions are present.*					
19. Gunakan peralatan hanya untuk tujuan yang ditetapkan. *Use equipment only for its designated purpose.*					
20. Bekas kimia tidak boleh dibiarkan terbuka semasa tidak digunakan. *Chemical containers should never be left open while not been using.*					

Arahan: Bagi setiap pernyataan di bawah, sila nyatakan sejauh mana tahap kefahaman anda dengan tandakan (√) dalam kotak yang berkenaan (1-5).

Instruction: *For each statement below, please indicate the extent of your level of understanding by tick (√) in the appropriate box (1-5).*

Tidak pernah / *Never*	**Jarang-jarang / *Rarely***	**Kadang-kadang / *Sometimes***	**Sentiasa / *Always***	**Selalunya / *Often***
1	2	3	4	5

BAHAGIAN 4: AMALAN MENGENAI KESELAMATAN MAKMAL

SECTION 4: PRACTICE ON LABORATORY SAFETY

	1	**2**	**3**	**4**	**5**
1. Saya sentiasa memakai seluar panjang dan kasut tertutup di dalam makmal. *I always wear long trousers and closed-toe shoes in the laboratory.*					
2. Saya kerap memakai pakaian pelindung seperti kot makmal semasa memasuki makmal. *I regularly wear protective clothing such as laboratory coats when entering the lab.*					
3. Saya akan memakai sarung tangan pelindung cermin mata keselamatan atau gogal untuk melindungi kulit dan mata saya daripada bahan yang mungkin berbahaya. *I will wear protective gloves safety glasses or goggles to protect my skin and eyes from potentially harmful substances.*					
4. Saya menanggalkan barang kemas semasa bekerja di makmal. *I put off the jewellery while working in the lab.*					
5. Saya masuk ke makmal dengan izin. *I enter the laboratory with permission.*					
6. Saya melabel semua bekas dengan sewajarnya.					

I label all containers appropriately.					
7. Saya tidak rasa atau sengaja menghidu bahan kimia. *I do not taste or intentionally sniff chemicals.*					
8. Saya membuang sisa kimia mengikut polisi kutipan dan pelupusan sampah dan tidak membuangnya ke longkang. *I dispose of the chemical waste according to trash collection and disposal policies and do not pour it down drains.*					
9. Saya mengikat rambut panjang saya dan mengikat pakaian longgar untuk mengelakkan kusut atau kemungkinan ditangkap. *I tie up my long hair and fasten loose garments to prevent tangles or possible capture.*					
10. Saya tidak makan, minum atau menggunakan kosmetik di makmal. *I do not eat, drink or apply cosmetics in the laboratory*.					
11. Saya tidak memotong kuku saya dengan gigi saya di makmal. *I do not cut my nails with my teeth in the lab.*					
12. Saya tidak menggunakan sedutan mulut untuk paip atau memulakan sifon. *I do not use mouth suction for pipetting or starting a siphon.*					
13. Saya perhatikan lokasi stesen cuci mata terdekat, alat pemadam api dan pancuran mandian keselamatan makmal. *I notice of the locations of the closest eyewash stations, fire extinguishers, and lab safety showers*.					
14. Pintu keluar kecemasan boleh saya akses. *Emergency exits are accessible to me.*					
15. Saya menjerit dengan segera dan sekuat-kuatnya untuk mendapatkan bantuan apabila saya cedera. *I yell out immediately and as loud as to get help when I am injured*.					

16. Saya memberitahu dan mendokumentasikan semua kemalangan dan kejadian berbahaya. *I notify and document all accidents and dangerous occurrences.*					
17. Saya tidak bekerja sendiri jika operasi makmal yang dijalankan adalah berisiko. *I do not work alone if the laboratory operations being performed are risky.*					
18. Saya meletakkan tanda amaran apabila bahaya luar biasa, bahan berbahaya, jentera berbahaya, atau keadaan luar biasa lain hadir. *I put up warning signs when exceptional dangers, dangerous substances, hazardous machinery, or other unusual circumstances are present.*					
19. Saya menggunakan peralatan untuk fungsi yang dimaksudkan dengan betul. *I utilize equipment for its intended function correctly.*					
20. Saya sentiasa menutup bekas bahan kimia. *I always close the containers of chemicals.*					