SAFETY CULTURE AWARENESS OF LABORATORY ACTIVITIES AMONG UNIVERSITI SAINS MALAYSIA (USM) ENGINEERING STUDENTS

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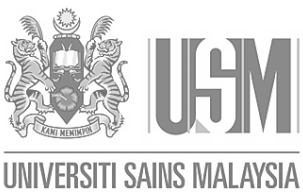

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USM	Universiti Sains Malaysia
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
WICA	Work Injury Compensation Act
SOP	Standard Operating Procedure
MCO	Movement Control Order
WHS	Workplace Health and Safety
COVID-19	Coronavirus Disease 2019
SMS	Safety Management System
IRA	Interrater Agreement

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SAFETY CULTURE AWARENESS OF LABORATORY ACTIVITIES (USM) ENGINEERING STUDENT

ABSTRAK

Pada masa kini, Malaysia menghadapi masalah keselamatan dan kesihatan pekerjaan yang serius disebabkan kecuaian di tempat kerja, yang mengakibatkan kemalangan yang tragis. Oleh itu, bagi mengelakkan kehilangan pekerja mahir, setiap organisasi perlu mengutamakan keselamatan pekerjaan dan kesihatan. Tahap universiti perlu memupuk budaya keselamatan pekerja melalui prosedur pembelajaran dan strategi pengajaran. Sebagai Langkah untuk meningkatkan kesedaran budaya keselamatan di peringkat universiti, budaya tersebut harus diterapkan semasa kaedah pembelajaran dan strategi pengajaran. Satu tinjauan dilakukan dengan 80 pelajar kejuruteraan USM menggunakan soal selidik yang dibahagikan kepada beberapa bahagian iaitu: A. Polisi OSH (OSH Policy), B. Kelengkapan Pelindung Diri (*Personal Protective Equipment PPE*), C. Keselamatan Mekanikal (*Mechanical Safety*), D. Keselamatan Alatan (*Tool Safety*), E. Amalan 5S (*5S Practice*), dan F. Bahaya dan pencegahan risiko (*Hazard and Risk Prevention*). Kemudian, soal selidik yang telah dijawab oleh responden dengan lengkap dianalisis dengan menggunakan Excel dengan kaedah analisis deskriptif untuk memperoleh data yang telah dianalisis. Data menunjukkan pelajar tahun dua mempunyai kesedaran mengenai keselamatan di dalam makmal yang lebih rendah berbanding yang lain. Oleh itu, kajian yang boleh dilakukan di masa akan datang adalah untuk meningkatkan kesedaran pelajar mengenai keselamatan di dalam makmal untuk semua pelajar degree di Universiti Sains Malaysia (USM).

SAFETY CULTURE AWARENESS OF LABORATORY ACTIVITIES (USM) ENGINEERING STUDENT

ABSTRACT

In Malaysia, where serious problems with worker safety and health are a result of workplace negligence, which can occasionally result in tragic accidents, occupational safety and health administration is an essential part of human resource management. To avoid losing skilled workers, controlling occupational safety and health should be given top priority in every plant and organization. The university level needs to increase safety awareness of students through learning procedures and instructional strategies. This study aims to study evaluate the level of safety awareness among undergraduates. A survey was done with 80 USM engineering students using questionnaires that are divided into a few sections: A. OSH Policy, B. Personnel Protective Equipment (PPE), C. Mechanical Safety, D. Tool Safety, E. 5S Practice, and F. Hazard and Risk Prevention. Then, the questionnaires that were fully answered by the respondents were analysed using Excel with the descriptive analysis method in the results. The results show that the safety awareness in laboratory of second year students is lower than the other batch. In conclusion, the future study that can be done are increasing the awareness on safety culture in laboratory of the students for different courses and year of study.

CHAPTER 1
INTRODUCTION

1.1 Introduction

This chapter will give a brief overview of the research project's introduction. This chapter will offer an outline of the factors that lead to industrial accidents. The research basis for this chapter will explain the definition and history of industrial accidents. The motivation, problem statement, research objectives, scope of the inquiry, importance of the study, and thesis organization will also be included in this chapter.

1.2 Research Background

An industrial accident is defined as a personal accident that is harmful to an employee and has been caused by an unplanned accident or an occupational disease that can cause serious physical damage, fatality, or health effects to the employee. Industrial accidents are unexpected events in the industry that occurred while an employee is performing their jobs. Industrial accidents have a great impact on the reduction of the profitability of the companies. First, as the industrial accidents took place, compensation will be granted to the workers under the Work Injury Compensation Act (WICA). This compensation will be given regardless of who was responsible for the accident, and it will be given even if the person is no longer employed by the firm. The corporation is the recipient of the funds obtained from the compensation. Hence, it will reduce the profitability of the company. This is one of the prevention steps to ensure that the top management guards and cares for the welfare of the employees and reduces industrial accidents at the workplace (Ministry of Manpower, 2021).

Second, the organization's output may be negatively impacted if there are any industrial accidents. There will be fewer people working for the company as more accidents occur in the factory. For instance, after the accident has taken place, the worker will request time off for medical reasons even if he has only sustained a slight injury. Accidents on the job may sometimes be so severe that they result in the employee's death or in the individual being permanently disabled. As a result, the top management of the organization is the one that has to take responsibility for the workers and locate new personnel to fill the vacancy. If one of these scenarios occurs, the production that is being overseen by the employee will be halted temporarily. As a result, it will harm productivity, which will, in turn, harm the profitability of businesses. (Kumar Choudhary B, 2018).

The growth of the global market and innovations in industrial technology contributes to the growth of the economy and have proven to have a favorable influence on the revenue of businesses. However, the number of accidents that occur in industrial workplaces is increasing in line with the expansion of technological capabilities and industrial endeavors. From previous research, the number of industrial accidents has been increasing for years and reaching a worrying level. Industrial activity includes all activities involved in converting raw materials into goods such as loading, unloading, maintenance, repairing, and welding. To perform industrial activities, the company needs to use various types of technology. Each industrial activity and new technology have different hazards and risks for different classifications such as automotive, electrical, electronic, aerospace, metalworking, chemical, and others. Hence, each hazard and risk have different ways of prevention according to their respective classifications.

To lower the probability of industrial accidents in line with technology advancement and industrial operations, businesses across Malaysia must adopt preventative steps to mitigate and avoid these increasingly prevalent safety hazards. Several precautionary measures may be implemented to avoid industrial accidents. The business may adhere to a workplace safety culture first. According to a study, businesses that adhere to a safety culture inside their organizations see a decrease in industrial accidents and have fewer safety concerns overall. The second step is for the business to determine any possible risks that could arise while carrying out the task. Potential risks include things like faulty standard operating procedures (SOP), broken equipment, radiation, and inadequate risk management. Finally, the business has to put in place the right safety precautions and procedures to avoid any workplace risks.

It is not surprising that a company's safety culture is not something that can be significantly improved in a short period. Any strategies that are implemented will need a significant amount of time before a positive change can be seen, as well as the elimination of many challenges, which requires a significant investment of resources on the part of an organization and a researcher (Nazaruk, 2011). Good safety culture in an organization comes from the ‘good’ safety beliefs, which have a lower possibility of misleading the goal that can be detected from the staff’s ‘poor’ safety behaviors (John, 2010). The behavioral repercussions of both positive and negative feedback contribute to the viability of beliefs because of feedback. Positive feedback is generated because of safety successes, while negative feedback might be noticed in the form of operational mishaps or the closure of a plant process.

Cultivating a "good" organizational safety culture is impossible to cultivate a "good" organizational safety culture without first cultivating shared safety attitudes (John, 2010). However, nurturing knowledge from an early stage in universities will be successful in establishing safety culture ideals among undergraduate students before they go anywhere in the industry for real career experience. This is because undergraduates have less time to learn about workplace safety before they enter the workforce. At the university level, learning methods and instructional methodologies should be used to raise the degree of security awareness among employees. Engineering students are required to participate in a variety of laboratory activities as part of their practical studies. Although the students recognize that the practical work, they perform in the laboratory is an essential component of their education, they are also aware that the work comes with several inherent dangers (Samaranayake et al., 2022).

One piece of research concluded that to enhance the safety culture, the mentalities of some employees need to be changed. This may be accomplished by the installation of yearly training sessions as well as properly prepared safety rules. Its purpose is to improve an individual's capacity to recognize, evaluate, and respond appropriately to potential dangers in the workplace, which will, in turn, contribute to an improvement in the existing culture of safety in the workplace (Samaranayake et al., 2022). The additional training sessions that are supplied by the organizations will put pressure on the company's ability to expand financially. Therefore, establishing a safety culture among students at an early stage is beneficial and capable of enhancing the positive feedback of safety culture belief, which is a fundamental concept necessary to create a good safety culture. This can be accomplished by beginning the process of establishing a safety culture (O’Toole, 2002).

The research was conducted at the Engineering Campus of the Universiti Sains Malaysia (USM), which is in Transkrian, Nibong Tebal, Seberang Perai Selatan, and Penang. This campus has a total enrolment of around 4000 students. The engineering program is broken down into six different schools, which are as follows: the School of Aerospace, the School of Civil Engineering, the School of Chemical Engineering, the School of Electrical and Electronic Engineering, the School of Materials and Mineral Resources Engineering, and the School of Mechanical Engineering. It is in line with USM's goal as well as the general expectations of the government to improve engineering studies to develop an all-around human resource that will serve as the heart and driving force for the growth and advancement of the nation. The development of this campus is in line with these goals, and it is in line with these expectations (*Campus Information*, n.d.).

Because of the pandemic that was brought on by the COVID-19 virus, institutions across the world, including USM, were required to go into lockdown, and students were barred from returning to campus because of the enforcement of Movement Control Orders (MCO) in March of 2020. (USM News Portal, 2020). There were limits placed on mobility, including prohibitions on travel on a national or worldwide scale, and it was completely forbidden for people to congregate for any reason (R I J E Ulfy, 2020). Because there was no other option, the administration of the university moved through with the implementation of an online learning system so that the students may continue their studies at home. This has resulted in a significant burden being placed on the students, who face a variety of difficulties while commencing their education entirely online. For example, there have been reports of difficulty in lab activities when the necessary components are not there, and it might

be difficult for people to completely comprehend the needs of their projects (Nassr et al., 2020).

Online learning continued for one year before the Minister of Higher Education (KPT) announced there would be six categories of students were allowed to Before the Minister of Higher Education (KPT) announced that there would be six categories of students who would be allowed to return to campus physically in March 2021 for Semester Two Academic Session 2020/2021, online learning continued for one more year. This was done by the standard operating procedure (SOP) (USM News Portal, 2021). Students who needed to participate in practical, laboratory, clinical, hands-on training, studio, or workshop sessions, as well as those who needed specialized equipment, fell into those groups. Students from various years of study and school were instructed to return to campus at a particular time to complete their traditional lab training. Despite this, the lab sessions for First-Year students during the previously stated academic session were postponed until the Academic Session 2021/2022. After that, the First-Year students' lab sessions will resume as normal. The dates that students will be admitted to the campus are shown in Table 1.1 below. Students attending the engineering campus will be readmitted to the campus between the 16th and 24th of October 2021.

Table 1.1 USM Engineering Students Entry Date

Campus	**Student Category**	**Entry Date**
Engineering Campus	New Students	16 October 2021
	Senior Students	22 – 24 October 2021

1.3 Problem Statement

Accidents at work are more likely to occur in environments with complicated machinery, regardless of whether the machinery is operated manually or mechanically. Not only may it be very traumatic, but it can also have a significant impact on the pace of productivity inside a business. Therefore, graduates with a more comprehensive understanding of safety awareness will be offering more than just a safe workplace, which not only promotes workers but also improves organizational behaviour and even productivity in the business. Since the global population is being affected by the Covid 19 outbreak, the purpose of this research is to survey to determine the level of safety culture awareness among engineering students at USM (Nassr et al., 2020). Many factors contribute to occupational safety and health accidents. The factors of the accidents can come from technical or mechanical failures and poor human performance (Hocking, 2005).

1.4 Objective

It was explained that having a strong safety culture in the workplace has advantages in addition to those related to safety, which not only promotes employee morale but also improves organizational behavior and even increases the productivity of the industry. This survey study is conducted to:

1. To study the safety culture that exists inside the laboratory as well as how workplace health and safety (WHS), as well as organizational performance, may be improved by a healthy safety culture.
2. To conduct a survey on safety awareness in laboratory activity of engineering USM students.

1.5 Scope of Project

The scope of this research project is focusing on the safety culture and issues in the laboratory. This is because the occupational accident rate in Malaysia has been increasing tremendously. Increasing the awareness of undergraduates on safety culture can prepare them for real-life working experiences. In this study, the respondent will be undergraduates from USM Engineering Campus, Nibong Tebal. The laboratories have various types of risks, damage, and injuries. Hence, this research study will review and emphasize the safety culture awareness in the laboratory activities of undergraduates.

1.6 Thesis Organization

This research paper will cover five major chapters for the purpose to figure out the research study. The first chapter is Chapter 1 which briefly introduces the research. It covers the research background, problem statement, research objectives, the scope of the study, and thesis organization. Next, chapter 2 discussed the critical review of the previous works of literature that are having a similar topic and area to this research paper. The reading summary of the source regarding the topic will be discussed in this chapter. Chapter 3 will explain the methods used for this research study. The topics discussed in this chapter are research design, data collection method, population and sampling technique, research instrument, questionnaire design, the scale of measurement, pilot test, and statistical data analysis. Chapter 4 is about the presentation and interpretations of the result. This chapter has discussed the result that this research gained from the data, the responses rate, data presentation, reliability analysis, and descriptive analysis. The last chapter is Chapter 5 which is about the conclusion of the whole research paper discussed in this chapter. The

implication of the study and limitations of the study will also be discussed in this chapter, and some suggestions and also recommendations are given in this chapter.

CHAPTER 2
LITERATURE REVIEW

2.1 History of Safety Culture

An industrial accident is described as a personal injury to an employee that is caused by an unforeseen accident or an occupational disease that can result in major bodily harm, death, or health impacts to the employee. Industrial accidents are unanticipated incidents that occur in the workplace while employees are conducting their tasks. Accidents in the workplace have a significant influence on the profitability of businesses. First, because of the industrial accidents, the employee will be compensated under the Work Injury Compensation Act (WICA), regardless of who was to blame and even if the person no longer works for the firm (Ministry of Manpower, 2021).

Since the late 19th century, or more than 120 years ago, there has been a focus on protecting workers' health and safety on the job. First and foremost, the safety of the steam boilers was prioritized, followed by the safety of the equipment. It was subsequently followed by occupational safety and health, which incorporates all work sectors, followed by industrial safety, industrial safety and hygiene, and finally occupational safety. This Department's past, present, and future can all be split down into six separate eras, each with its history, functions, and developments. (DOSH, 2019). The eras are as listed below:

1) Steam Boiler Safety Era – before 1914
2) Machinery Safety Era – 1914 till 1952
3) Industrial Safety era – 1953 till 1967
4) Industrial Safety and Hygiene – 1970 till 1994
5) Occupational Safety and Health Era – after 1994
6) Occupational Safety and Health -Master Plan 2015
7) Occupational Safety and Health -Master Plan 2020

The 2016-2020 Occupational Safety and Health Master Plan is a tool and plan that was developed to further boost national occupational safety and health (OSH) to significantly increased seeking to preserve the country's human resources. These human resources are an essential and valuable resource to the accomplishment of national development programs to fulfill the goals of Vision 2020 (DOSH, 2019). Occupational Safety and Health Administration (OSHA) has developed the following guidelines during the evolving Coronavirus Disease 2019 (COVID-19) pandemic to aid employers and workers in safe conditions returning to work and rebuilding businesses that have been regarded by local officials to be "non-essential businesses." These guidelines were developed to assist employers and workers in returning to work and reopening businesses during the pandemic. Employers may make use of this information in the development of policies to safeguard their workforce from potential hazards to ensure the health and safety of their workforce (OSHA, 2020). Excellence OSH level would enhance the employee's quality of life and thus result in higher productivity and index components under the Work Environment Index of Malaysia Social Welfare following the policy and the nation's transformation strategy to achieve Vision 2020 (DOSH, 2019).

This master plan is an updated version of the previous Occupational Safety and Health strategy plan, as well as a master plan from 2006 that was centered on promoting a Safe and Healthy Work Culture among employees and employers. A strategic program called "Safe and Healthy Work Culture" was established in Malaysia to reduce the number of work-related deaths and illnesses that are caused by employees' jobs. The OSH-MP 2020 focuses primarily on fostering the development of a preventative culture in the workplace as its principal strategy (DOSH, 2019). This plan will carry on the implementation and inculcation of the concept of responsibility and self-regulation that was started in the two plans that came before it to encourage the establishment of a Safe and Healthy Work Culture among employers and workers.

The Preventive Culture places great value on awareness, responsibility, and commitment among employers and employees, respecting the rights of workers regarding occupational safety and health, support and guidance of worker participation in OSH activities, improved OSH knowledge and expertise, and skillful OSH management based on effective risk management. The goal objective is the transformation of the workplace into a safe and healthy environment to preserve the most valuable asset which is the employees. Since the execution of the last two strategic plans, the number and rate of workplace accidents have decreased, resulting in a greater work environment index as measured by the Index of Social Welfare Malaysia. (Department of Statistic Malaysia, 2020).

With the perception that a Safe and Healthy Work Culture will improve the well-being of employers, workers, and the nation, the five-year OSH-MP 2020 tends to focus on lowering the rate of fatalities and injuries by 10% by reducing the frequency of accidents to 2.53 per 1,000 workers and the rate of fatalities to 4.36 per 100,000 workers by 2020. This OSH master plan will also guarantee a 30% growth in the reporting of occupational illnesses and poisonings between 2015 and 2020. To accomplish this aim, the OSH-MP 2020 deploys five primary tactics based on the effort to raise stakeholder awareness, obligation, and commitment to occupational safety and health. All sectors must collaborate to fulfill their various tasks and functions to build a safe and healthy workplace by instilling the Preventive Culture's core principles. These five initiatives include Government leadership, improvement of occupational safety and health management, OSH sharing and connection, worldwide OSH strategic alliance, and mainstreaming of industrial hygiene (DOSH, 2019).

These five OSH-MP 2020 initiatives are, in turn, reinforced by a variety of programs and activities that are centered on cultivating a preventive culture among companies and employees (Sabah Occupational Safety, 2020). The Occupational Safety and Health Management Plan for 2020 (OSH-MP 2020) outlines the duties and responsibilities of all stakeholders, including the government, associations, competent persons, and relevant parties with influence over employers and workers. This is to ensure that the plan will be successful in addition to the commitment of employers and workers. This master plan is intended to bring about an improved quality of working life for employees, increased organizational productivity and competitiveness, and thus contribute to the improvement of Malaysia's Welfare Index as a guide to the quality of life of Malaysians. The success of this plan depends on the involvement and cooperation of all parties involved (DOSH, 2019).

2.2 Industrial Accidents in Malaysia for All Sector

Occupational disease can occur in any sector; hence, the top management of every company must take an action to reduce the occupational disease that would lead to death risk. **Figure 2.1** shows the number of occupational diseases in all sectors from 1997 to 2009. From the figure, the number of occupational diseases decreased from 832 in 1997 to 194 in 2005. However, the number of occupational diseases increased since 2006 from 194 to 515 in 2008. SOCSO reported that the number of occupational diseases keep increasing until 2009 with 954 cases. Most occupational diseases involve mainly hearing, lung, skin, musculoskeletal disorders, cancer, physical agent, biological agent, and chemical agent (Au Yong, 2014). Occupational disease can occur in any sector; hence, the top management of every company must take an action to reduce the occupational disease that would lead to death risk.

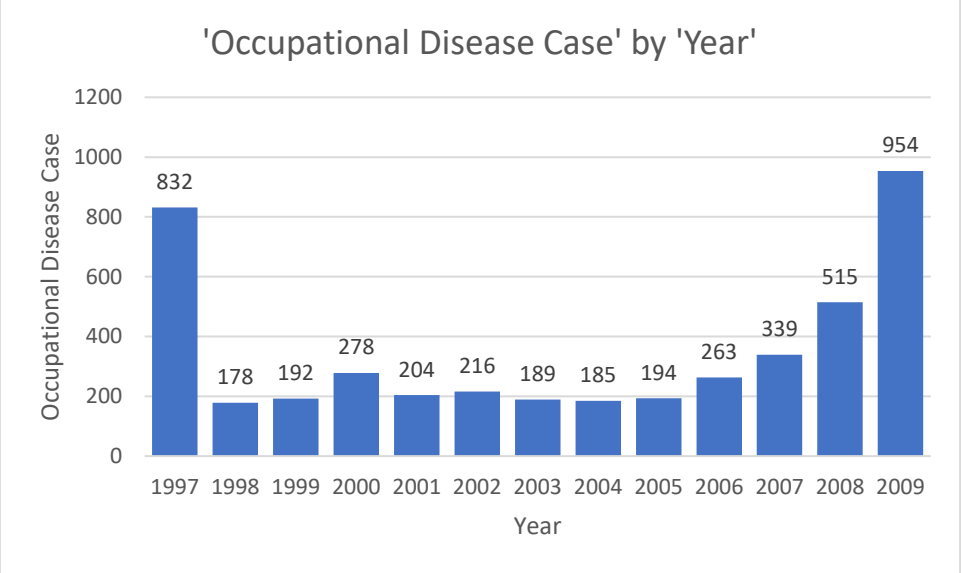

Figure 2.1 Number of Occupational Diseases 1997-2009 (SOCSO.)

Figure 2.2 shows that the manufacturing sector has the highest number of occupational diseases and poisoning in 2015, with 3487 cases (86.4%) (DOSH, 2015). The second highest in the public services and statutory bodies sectors with 149 cases (3.7%). Then, it was followed by the agriculture, forestry, logging, and fishery sectors with 122 cases (3.2%) (D. Ali et al., 2017). **Figure 2.3** shows the reported occupational disease increases every year from 2012 until 2016.

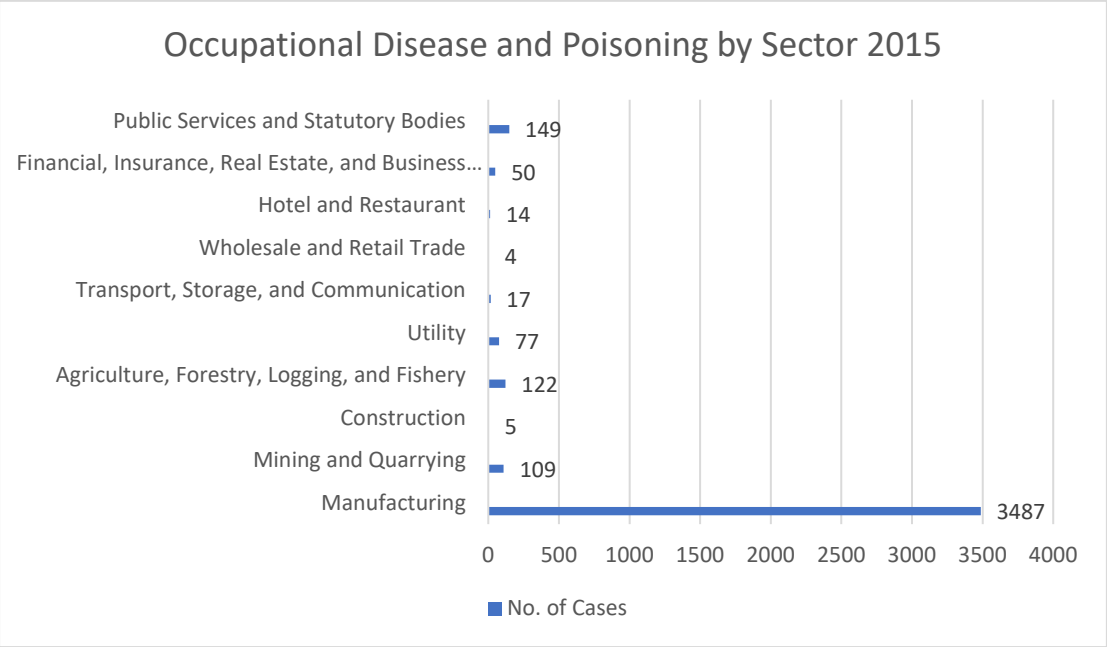

Figure 2.2 Occupational Disease and Poisoning by Sector 2015

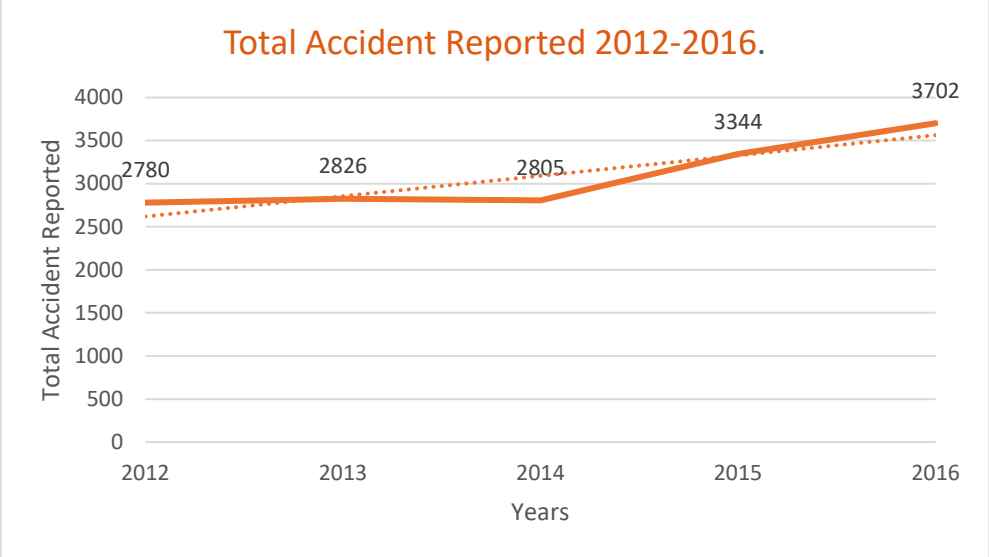

Figure 2.3 Number of Reported Accidents 2012-2016 (D. Ali et al., 2017)

2.3 Malaysia Occupational Accidents by Sector in 2021

A greater progression in modern assembling forms with a subsequent increment in the field of industrial manufacturing with the upcoming growing technology has led to led a disease impact on human health and occupational safety and health accident (Kumar Choudhary B, 2018). The data shown in **Table 2.3** below pertain to occupational accidents that occurred in each state from January to October of 2021 (DOSH Profile, 2022). This death shows that the permanent disability values are 12 cases and 562 non-permanent disability cases in Pulau Pinang.

Table 2.1 Occupational accidents by state from January until October 2021

Non-Permanent Disability	Permanent Disability	Death	Total
562	12	6	580

The total number of accidents in the Manufacturing Sector has risen incredibly starting in 2018 and has not been reducing until now. In **Figure 2.4**, it states that sector manufacturing contributed the highest total occupational accidents in 2021 with 3253 cases of non-permanent disability, 166 permanent disability, and 43 death cases for last year's statistics. This depicts a total of 3462 occupational accident cases for the manufacturing sector in the year 2021. Below are the statistics data from the Department of Occupational Safety and Health of Malaysia for occupational accidents in Malaysia from 2015 until 2021 in the manufacturing sector. The data in 2021 only count from January until October as the Department of Occupational Safety and Health has not updated for the full year until they have investigated all the cases in that year (DOSH, 2021).

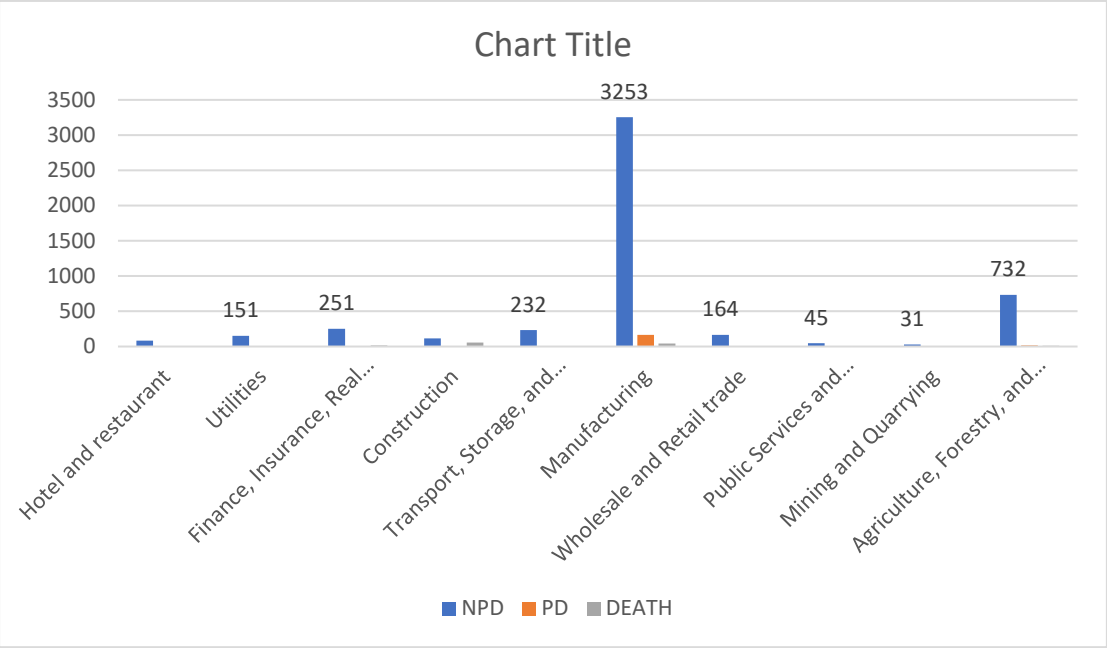

Figure 2.4 Occupational accidents by sector from January until October 2021

2.4 Elements in Survey Questionnaire

Laboratory safety practices can cause laboratory accidents and severe injuries studied by Ariffin et al., (2012) where lots of the accidents are connected to high-risk job sectors such as construction, chemical industries, engineering, and technologies (Furr, 2000). It is the organization responsibility to ensure the students safety during laboratory activities (Ariffin et al., 2012). This is why early training should be provided to the students before doing practical activities in laboratories (Samaranayake et al., 2022). The explanation of laboratory training that has been gone through by all first-year students in USM Engineering Campus can be divided into a few sections which are: OSH Policy, Personal Protective Equipment (PPE), Mechanical Safety, Tool Safety, 5S Safety, and Hazard and Risk Prevention.

Occupational Safety and Health (OSH) is a crucial part of risk reduction in the workplace. It is a standard established by law with the intent of eliminating and reducing occupational dangers. In addition to occupational safety and health, safety culture is a significant factor in decreasing workplace risk and accidents (Amirah et al., 2013). The implementation of the Occupational Safety and Act (OSHA) on 24 February 1994 and the Act is comprised of 67 sections, 15 divisions, and three schedules. The first three sections describe the purposes of the Act and provide the groundwork for the selection of officials and the National Council (Ministry of Human Resources Malaysia, 2006). Some of the laws from OSHA are the Regulations Under Factories and Machinery Act 1967 (Act 139) from DOSH, (2006), and Environmental Quality Act 1974 (Act 127) (DOSH, 1974). This was issued based on the principle of self-regulation, with the main duty for ensuring workplace safety and health resting with those who produce and deal with the hazards (Ministry of Human Resources Malaysia, 2006).

Personal protective equipment, sometimes known as "PPE," refers to protective gear used to reduce exposure to several risks (Samaranayake et al., 2022). It is the last line of defense that must be used in administrative and engineering controls that are unable to bring the degree of risk down to an acceptable level (Vierendeels et al., 2018). A few types of PPE give protection to the human, which are eye and face protection, head protection, foot and leg protection, hand and arm protection, body protection, and hearing protection. Employers must supply personal protective equipment (PPE) to their workers and ensure that it is used when engineering, work practices, and administrative controls are impractical or insufficient (OSHA, 2004).

Safe machines significantly contribute to the safety of employees on the job. Safety devices often ensure or improve the safety of the equipment. According to the European Commission, (2009) between 1995 and 2005, the fatal accident rate per 100,000 employees in the manufacturing sector decreased from 4 to around 2.5, while the non-fatal accident rate decreased by almost 20% compared to 1995 levels. The selection of a safety device requires a judgment based on various factors and a rating of options according to often contrasting performance measurements. Some of the most common industrial injuries include being hit by or against an item, being caught in or squeezed by machinery, and being trapped in or crushed by collapsing material. In practical labor or industries, strict laws or Standard Operating Procedures (SOP) have been enacted specifying precise safety standards that equipment must meet (Caputo et al., 2013).

Using substandard equipment and tools is particularly dangerous since it may directly result in worker injuries (St et al., 2001). Accidents involving faulty equipment are caused by its poor performance. Inadequate management of the procurement and maintenance of safety equipment will increase casualties. According to St et al., (2001), a building site is one of the most hazardous or unsafe environments that may provide several dangers to construction employees. The technique of housekeeping entails the correct storage, use, cleaning, and disposal of the different building materials (A. S. Ali et al., 2010). Cheung, (2005) reports that daily and weekly safety inspections were undertaken to verify that all devices and equipment were in working order and excellent condition. Inspection and testing must be conducted by competent personnel and all equipment and machinery must be thoroughly examined before being put into service.

5S is a strategy for arranging areas so that work may be completed in an efficient, effective, and safe manner. This method prioritizes placing things where they belong and maintaining a clean workplace, making it simpler for employees to do their tasks without wasting time or risking damage. The adoption of the 5S approach in university organizations offers a foundation for establishing organizational culture and implementing continuous improvement criteria. This applies to both the teaching and non-teaching procedures as well as the student-learning processes. The new culture has led to an improvement in the working environment and a rise in employee motivation (Jiménez et al., 2015). This type of approach can instill safety culture attitudes among the undergraduates with the hope that safety culture awareness can be increased among the students.

An essential aspect of safety management system (SMS) planning is the development of hazard identification and risk assessment procedures and the establishment of organizational-level risk acceptance criteria. An institution as complicated as a university or research laboratory seems to need a systematic procedure for risk assessment. In university academic and research laboratories, a range of hazards exist, and the risks connected with the studies conducted in these labs may be severe if not effectively handled (Olewski & Snakard, 2017). Marendaz et al., (2013) present an approach based on the Assessment and Classification of Laboratory Hazards (ACHiL) which enables professionals to analyze the amount of danger in their laboratory using an innovative platform. This instrument comprises a list of 28 specific hazards categorized on a four-level scale (from 0 to 3), enabling the identification of labs with a high degree of risk or cumulative hazards.

Table 2.2 shows the elements involved in the survey questionnaire and the number of questions involved in each element. Section A elicited the OSHA Policy that was implemented by the organization, Section B focused on Personnel Protective Equipment (PPE), Section C on Mechanical Safety, Section D on Tool Safety, Section E on 5S Practice in a laboratory, and Section F on hazard and risk prevention.

Table 2.2 Elements involved in the survey questionnaire

Section	Number of items
A. OSHA Policy	2
B. Personnel Protective Equiment (PPE)	2
C. Mechanical Safety	2
D. Tool Safety	2
E. 5S Practice	3
F. Hazard and Risk Prevention	2

2.5 Research Design

Research designs are often evaluated based on how closely they resemble qualitative or quantitative research procedures. Regularly, social surveys and experiments are considered to be excellent examples of quantitative research and are assessed based on the exemplifications of the benefits and drawbacks of statistical, and quantitative research methodologies and analysis. On the other hand, contextual investigations and case studies are often highlighted as great examples of qualitative research. This kind of research takes an interpretive approach to the material and analyses the subjective meanings that individuals give to their surroundings (David, 2001).

In this particular research study, the research design that was used was the quantitative research design. Quantitative research designs may be broken down into four primary categories: descriptive, correlational, quasi-experimental, and experimental (Djamba & Neuman, 2002). Collecting information and data that characterize occurrences as part of descriptive research, followed by tabulating the data and explaining the data collected, are all components of the research process (Steiger, n.d.). The collection of descriptive data often makes use of survey techniques. Censuses of populations, extensive data collecting on a variety of social and economic variables, and information gathering are all components of descriptive research. Descriptive research data contain the lowest possible value, the highest possible value, the mean, and the standard deviation of each item. The purpose of doing descriptive research is to characterize the current status of a certain variable. These research efforts are being undertaken to provide a methodical comprehension of a phenomenon. In most cases, the researcher will not start with a hypothesis; nonetheless, one may be established following the gathering of data. The data are broken down and then put back together again to provide an evaluation of the hypothesis. The thorough selection of the units that are going to be studied and the accurate measurement of each variable are both requirements for systematic data gathering (Djamba & Neuman, 2002).

The goal of correlational research is to establish the degree of connection that exists between two or more variables by making use of statistical data. This method of design investigates and concludes the connections that exist between and among various sets of data. This kind of research finds trends and patterns in the data; however, the analysis does not establish the causes for these patterns that have been discovered. This kind of research relies on correlation rather than causation to get its conclusions. The only things that are looked at are the data, relationships, and distributions of the variables. Variables are not changed; rather, their natural states are recognized and investigated in their entirety (Rahman, 2017). The purpose of quasi-experimental research is to identify correlations between variables and their underlying causes. These designs are fairly like real trials, with just a few significant deviations. The effects of an independent variable on the dependent variable are evaluated after an independent variable has been identified but not altered. Then, the researcher must use organically developed or pre-existing groups as opposed to randomly allocating them. Identified control groups that were exposed to the treatment variable are compared to control groups that were not exposed (Rahman, 2017).

Experimental research, also known as actual experimentation, uses the scientific method to establish the cause-and-effect relationship between the variables of a study. A laboratory environment has little to do with the actual experiment, despite popular belief. A real experiment is one in which every effort is made to identify and control all variables except one. Manipulating a variable independently to determine its effect on variables dependent. As opposed to being divided into naturally occurring categories, subjects are assigned experimental treatments at random (Rahman, 2017). Sampling is the technique for choosing a sample from the