



UNIVERSITI PUTRA MALAYSIA

***THE EFFECTS OF TRAINING ON THE KNOWLEDGE LEVEL OF
HAZARD IDENTIFICATION RISK ASSESSMENT AND RISK
CONTROL (HIRARC) AMONG ENGINEERING STUDENTS IN
UNIVERSITI PUTRA MALAYSIA***

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**BY
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**Thesis submitted in fulfilment of the requirement for the degree of Bachelor
Science (Environmental and Occupational Health) from the Faculty of Medicine
and Health Sciences, Universiti Putra Malaysia.**

ACKNOWLEDGEMENTS

First of all, I would like to express my deepest gratitude to my supervisor, Associate Professor Dr. Emilia Zainal Abidin, for her advice, encouragement, support and assistance to complete this project throughout numerous consultations. I will not complete this project successfully and on time without her guidance.

Thank you to the Department of Occupational Safety and Health, Faculty of Medicine and Health Science, Universiti Putra Malaysia for giving me the opportunity to do my final project. Besides that, special appreciation to Associate Professor Dr. Wan Zuhairi bin Wan Hasan, the Deputy Dean of Undergraduate Studies and to all the staff from the Faculty of Engineering, Universiti Putra Malaysia for their cooperation and help while I am completing this project.

I also would like to thank to all my family members, people from my department and friend for their support and care throughout my final year project.

ABSTRACT

THE EFFECTS OF TRAINING ON THE KNOWLEDGE LEVEL OF HAZARD IDENTIFICATION RISK ASSESSMENT AND RISK CONTROL (HIRARC) AMONG ENGINEERING STUDENTS IN UNIVERSITI PUTRA MALAYSIA

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Introduction: Engineers play a key role in making sure the design of machines follows the safety aspect required. Although most machine built was already equipped with safety control such as guard, sensor and others, however, the accident still occurred because of other factors such as lack of management control, inadequate standards, less communication, machine design and others. Engineers with Hazard Identification Risk Assessment and Risk Control (HIRARC) knowledge could help eliminate the hazard from the designing phase, thus might reduce the probability of accident from occurring. **Objectives:** To measure the effect of training on knowledge level related to Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students. **Methodology:** This was an interventional study that used developed questionnaire to compare the knowledge level of HIRARC among UPM engineering students before and after training. This study was conducted among the final year engineering students in the Faculty of Engineering, UPM. A total of 70 respondents participated based on the inclusion and exclusion criteria. The respondents were given the pre-intervention followed by the training on HIRARC using a module made by the researcher and after that, they answered the post-intervention. Then the data analysis was performed by using SPSS version 25. **Results:** This study involved 70 respondents from three different courses which are 28.6% (n=20) Civil Engineering, 38.6% (n=27) Agricultural and Biosystem Engineering and 32.9% (n=23) Mechanical Engineering. After the pre and post-intervention, Wilcoxon signed ranks test result showed a significant increase in the knowledge level of HIRARC. The knowledge increased from 10 (9-11) to 14 (13-15). Chi-square test also showed there was an association between respondents' knowledge level of HIRARC for the pre-intervention and the older age group of respondent's **Conclusions:** The training module had potential in increasing the knowledge level of HIRARC. The module could be used in any educational institution to give the students understanding and awareness on the importance of safety that could be beneficial for them before going into the working environment.

Keywords: Engineering, Hazard Identification Risk Assessment and Risk Control (HIRARC), Knowledge, Training

ABSTRAK

KESAN LATIHAN TERHADAP TAHAP PENGETAHUAN PENGENALPASTIAN HAZARD, PENAKSIRAN RISIKO DAN KAWALAN RISIKO (HIRARC) DI KALANGAN PELAJAR KEJURUTERAAN DI UNIVERSITI PUTRA MALAYSIA

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Pengenalan: Jurutera memainkan peranan yang sangat penting dalam memastikan reka bentuk mesin mengikut ciri-ciri keselamatan yang diperlukan. Walaupun kebanyakan mesin yang dibina sudah dilengkapi dengan kawalan keselamatan seperti penghadang, sensor dan lain-lain, namun begitu, kemalangan masih juga berlaku kerana faktor-faktor lain seperti kurangnya pengawasan dari pihak atasan, standard yang tidak mencukupi, kurangnya komunikasi, reka bentuk mesin dan lain-lain. Jurutera yang mempunyai pengetahuan tentang Pengenalpastian Hazard, Penaksiran Risiko dan Kawalan Risiko (HIRARC) dapat membantu untuk menghapuskan bahaya dari fasa perancangan, dengan itu boleh mengurangkan kebarangkalian kemalangan daripada berlaku. **Objektif:** Mengenalpasti kesan latihan terhadap tahap pengetahuan Pengenalpastian Hazard, Penaksiran Risiko dan Kawalan Risiko (HIRARC) di kalangan pelajar kejuruteraan UPM. **Metodologi:** Ini merupakan kajian intervensi yang menggunakan borang soal selidik yang dirangka sendiri oleh penyelidik untuk membandingkan tahap pengetahuan HIRARC di kalangan pelajar kejuruteraan UPM sebelum dan selepas latihan. Kajian ini dijalankan di kalangan pelajar kejuruteraan tahun akhir di Fakulti Kejuruteraan, UPM. Sebanyak 70 responden terlibat mengikut kriteria yang telah ditetapkan. Responden diberi borang soal selidik diikuti oleh latihan HIRARC menggunakan modul yang dibuat oleh penyelidik dan selepas itu, mereka menjawab semula borang itu. Kemudian data analisis dijalankan menggunakan SPSS versi 25. **Keputusan:** Kajian ini melibatkan 70 responden dari tiga kursus yang berbeza iaitu 28.6% (n = 20) Kejuruteraan Awam, 38.6% (n = 27) Kejuruteraan Pertanian dan Biosistem dan 32.9% (n = 23) Kejuruteraan Mekanikal. Keputusan ujian *Wilcoxon signed ranks* menunjukkan peningkatan ketara dalam tahap pengetahuan HIRARC. Pengetahuan HIRARC telah meningkat dari 10 (9-11) kepada 14 (13-15). Ujian *Chi-square* juga telah menunjukkan terdapat hubungan antara tahap pengetahuan awal responden mengenai HIRARC dan responden dari kumpulan umur yang lebih tua. **Kesimpulan:** Modul latihan ini mempunyai potensi untuk meningkatkan tahap pengetahuan HIRARC. Modul ini boleh digunakan di mana-mana institusi pendidikan untuk memberi pemahaman dan kesedaran tentang pentingnya keselamatan dan boleh juga memberi manfaat kepada pelajar sebelum memasuki alam pekerjaan.

Kata kunci: Kejuruteraan, Pengenalpastian Hazard, Penaksiran Risiko dan Kawalan Risiko (HIRARC), Pengetahuan, Latihan

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LIST OF ABBREVIATIONS

CGPA	Cumulative Grade Point Average
CIDB	Construction Industry Development Board
CPR	Cardiopulmonary Resuscitation
DOSH	Department of Occupational Safety and Health
FMA	Factories and Machinery Act
HAZOP	Hazard and Operability
HIRARC	Hazard Identification Risk Assessment and Risk Control
ILO	International Labour Organization
MOE	Ministry of Education
MyGAP	Malaysian Good Agriculture Practice
MOA	Ministry of Agriculture
NIOSH	National Institute for Occupational Safety and Health
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Act
SPSS	Statistical Package for Social Sciences
SOCISO	Social Security Organization
UPM	University Putra Malaysia
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background of study

Engineering is a branch of science and technology that concerned with designing, building with the use of engines, machines and structures based on Oxford dictionaries (Oxford, 2018). The field of engineering combines various fundamentals such as mathematics, science and technology. The engineering field also comprises of various major branches such as chemical, mechanical, civil, aerospace and others. Although they have already learned many things related to their field, they still lack knowledge about safety that needs to be implemented in the system (Noakes et al., 2011). Thus, this field is crucial because engineering has bigger chances to eliminate and reduce hazard at the workplace compare to other professions (Behm et al., 2014). With knowledge on Occupational Safety and Health, a better design of machine can be built with better safety measure.

Occupational safety and health is very important that most of the country have made regulations about it. In Malaysia, the act is called the Occupational Safety and Health Act (OSHA) 1994 (Act 514). This act was enacted to secure the safety, health and

welfare of persons at work and protect all the workers from risk to safety and health. This act will be practice to industries listed in the First schedule throughout Malaysia such as manufacturing, mining, quarrying, construction and others. Other than the OSHA Act 1994 there is also Factories and Machinery Act (FMA) 1974 (Act 139). This act is more focus on the control of factories and machinery that relate to safety, health and welfare of person working in it which include registration, inspection and others. However, both of this law was enacted to make sure safety, health and welfare of the workers are in good hand. There is also a government agency called the Department of Occupational Safety and Health (DOSH) that is responsible for the administration and enforcement of the legislation.

International Labour Organization (ILO) interpret Occupational Safety and Health (OSH) as a broad scope that involved many specialized fields with the aim to reduce or prevent the risk of a person to get injured during work, get health problems caused by the work. ILO also highlighted several causes of accident happen to workers such as lack of management control, inadequate standards, less communication, machine design and others. All of this will become a hazard to the workers as hazard can be defined as any source or situation that have potential of harm in term of human injury or ill health, damage to property, environment or combination of these (Guidelines for Hazard Identification, Risk Assessment and Risk Control, 2008). Example of hazards are physical hazards, chemical hazards, biological hazards, ergonomic hazards and psychosocial hazards. Hazards that are not managed properly will result in serious injuries, occupational illness and even death to the workers (Castilhos et al., 2015).

Hazards that cannot be identified by managers and workers at the workplace may cause occupational injury and accidents to occur. International Labour Organization (ILO), define occupational injury as the result of an occupational accident that causes personal damage, disease and fatal. In the other hand, the World Health Organization (WHO) indicates occupational accident as any disease resulted from exposure to risk factors appear from the activity. In order to maintain the safety and health of employees, it is necessary to have a safety system that analyses risk and their outcome (Saedi et al., 2014).

According to the Department of Occupational Safety and Health (DOSH), National Occupational Accident and Fatality Rate statistic in Malaysia states that the Accident rate in Malaysia increase from 2015 to 2017. Meanwhile, the fatality rate also increase from 2016 to 2017. There must be reasons why the statistics still increase although control measure has already been taken. If we fail to figure out how to solve the main problem, the same kind of accident may repeat again. This day, almost all machine built is already equipped with safety control such as guard, sensor and others. However, the accident still occurs because of other factors such as the system, the place of the machine, surrounding and the worker's behavior.

1.2 PROBLEM STATEMENT

The Occupational Safety and Health practice has improved over the years in Malaysia. The Acts had covered 90% of the nation's total manpower rather than the Factory and Machinery Act 1967 that only covers 24% of it (Manaf, 2018). The enforcement of this act shows that the Malaysia government is real concern about the importance of safety at the workplace. In OSHA 1994 (ACT 514) it is stated in section 15 that it shall be the duty of every employer and every self-employed person to ensure, so far as practicable, the safety, health and welfare at work of all his employees. In section 16 also talk about the duty of the employer and self-employed person to prepare policy related to safety and health.

However, the occupational accident still happens, and the numbers are still increasing. Social Security Organization (SOCSO) reported that accident in the construction industry in 2011 is 4330 cases while in 2016 are 7338 cases. It is an increase of 69.47% from 2011 to 2016. If unreported cases also been taken into account, the numbers will be much higher. Meanwhile, based on the statistics cases investigated by DOSH, the construction sector shows the highest number of deaths which is 52 and the next is 16 deaths in manufacturing sectors. Furthermore, manufacturing sectors show the highest number of non-permanent disability which is 825 cases and 54 cases for permanent disability. These two sectors are the main causes of accidents and injury in Malaysia (DOSH, 2018).

Everyone was involved in minimizing risks at their workplace (Goh & Chua, 2016). However, engineers played the biggest key role in maintaining a machine or system in good condition. A study found that there are still designers who still had a low mindset and do not think that safety and health was part of their job (Brace, 2009). The engineers that designed the machines did not think seriously to implement the safety and health method in their design. A study in the US found that there was lack of safety measure implemented during the design process because of the designers' mindset, their lack of safety knowledge and their work tasks and they did not fully understand how a good and safe practice looks like (Gambatese et al, 2005). Without safety mindset, it will be difficult to provide any solutions.

However, some universities did not teach safety as their core subject. It is an elective for the student to choose whether to learn it or not. Based on the course structure of engineering students from a public university in Malaysia such as Universiti Putra Malaysia (UPM) and Universiti Kebangsaan Malaysia (UKM) and private university in Malaysia such as Taylor's University. They did not put safety as the core course to learn. The engineering courses do not have a specific course that teaches specifically on safety or hazard and risk assessment. They only had a sub-topic of safety in certain of the course. If engineers were taught about the safety and health and HIRARC in their syllabus during their studies the safety will be better.

Lastly, there is still no study that conducted training on Hazard Identification Risk Assessment and Risk Control (HIRARC) among engineering students in Malaysia. Previous studies on HIRARC that were conducted only among the workers in the industries, radiation facilities sector and construction site (Kasim et al., 2018 and Saedi et al, 2014). Tan Sri Lee Lam Thye, The Chairman of National Institute of Occupational Safety and Health said that training and education are very important to improve the safety and health, especially in the construction sites (New Straits Time, 2018). He also emphasized that contractors must implement OSH practices, including adopting HIRARC, which is the concept of hazard identification, risk assessment and risk control. HIRARC is a tool that is use in many industrial sector to assess hazards and their associated risks as well as to provide method to control the risk This tool helps in reducing incidents in the workplace and can create awreness among the employees. Thus, if the engineers are being taught about the HIRARC, earlier while they are in the university, it could promote safer work place and work practice.

1.3 STUDY JUSTIFICATION

There are already many studies that study the safety practice and the risk assessment among workers in Malaysia such as to improve the behavioral safety performance of workers in the construction industry (Mazlina & Hadikusumo, 2017), safety culture practices in Malaysia radiation facilities. (Kasim et al, 2018) and common causes and solutions of workplace accidents in Malaysia (Zakaria et al, 2012), so this study will just focus on developing simple module and giving training on HIRARC to the engineering students. Furthermore, the information is beneficial, and the students can even use it when they are working in the future. When the knowledge is implemented the numbers of the accident and injuries can be reduced and it will make the workplace a safe place for the workers. Safety intervention is important and needed to be done so that people bad behavior can change (Rikhadrsson & Impgaard, 2005). The intervention activities will be a win-win situation where the health and wellbeing of the workers will be better, increase motivation and job satisfaction (Kristensen, 2005). Moreover, product quality, productivity and customer satisfaction will also be increased through this initiative.

This study was necessary to determine the current knowledge level related to HIRARC among UPM engineering students and their awareness through the questionnaire. To prevent and control the occupational injuries, illnesses and fatalities, control measure must be taken at the early stage by designing or minimizing the risk which is the job of the employer (Behm et al, 2014). This awareness needs to be encourage and exposed to the students who will be the engineers in the future that safety is everyone

responsibility not only the job for a person involved with safety and health work such as the employer, safety officer or the safety and health committee.

Through this training, the engineering students' knowledge level of HIRARC will increase. The students will understand the engineering responsibility towards safety and can also counter and identify the risk at the early stage of a process or work. This study will help the Ministry of Education (MOE) to evaluate and observe the current engineering students' knowledge level related to HIRARC. As a result, a countermeasure can be done to improve the education system in Malaysia towards graduate that will be working in the industry. Lastly, an intervention program was provided through HIRARC training module which is delivered through slide presentations. This module taught the UPM engineering students on HIRARC knowledge and other related things. This module then could be used by the university or by the National Institute of Occupational Safety and Health (NIOSH) to teach other people about HIRARC.

1.4 CONCEPTUAL FRAMEWORK

Figure 1.4.1 shows the conceptual framework of this research. The research will be done among engineering students in Universiti Putra Malaysia (UPM). The engineering students need to know about the HIRARC as it will be useful for them when they are working in the future. Moreover, the field that they will enter involve many kinds of hazards that involve machine and the surrounding. As an engineer, they must know how to take care of their own safety and safety of the people around them by designing a system or machine that is safe for everyone to use it. There are various ways that the student can get the OSH knowledge and learn HIRARC such as based on their Industrial training experience, reading, media like the magazine, internet and also from their studies curriculum. The safety, health and welfare of the workers will be affected if the hazard in the workplace is not secure. The HIRARC training will benefit the student and increase their knowledge of safety and health.

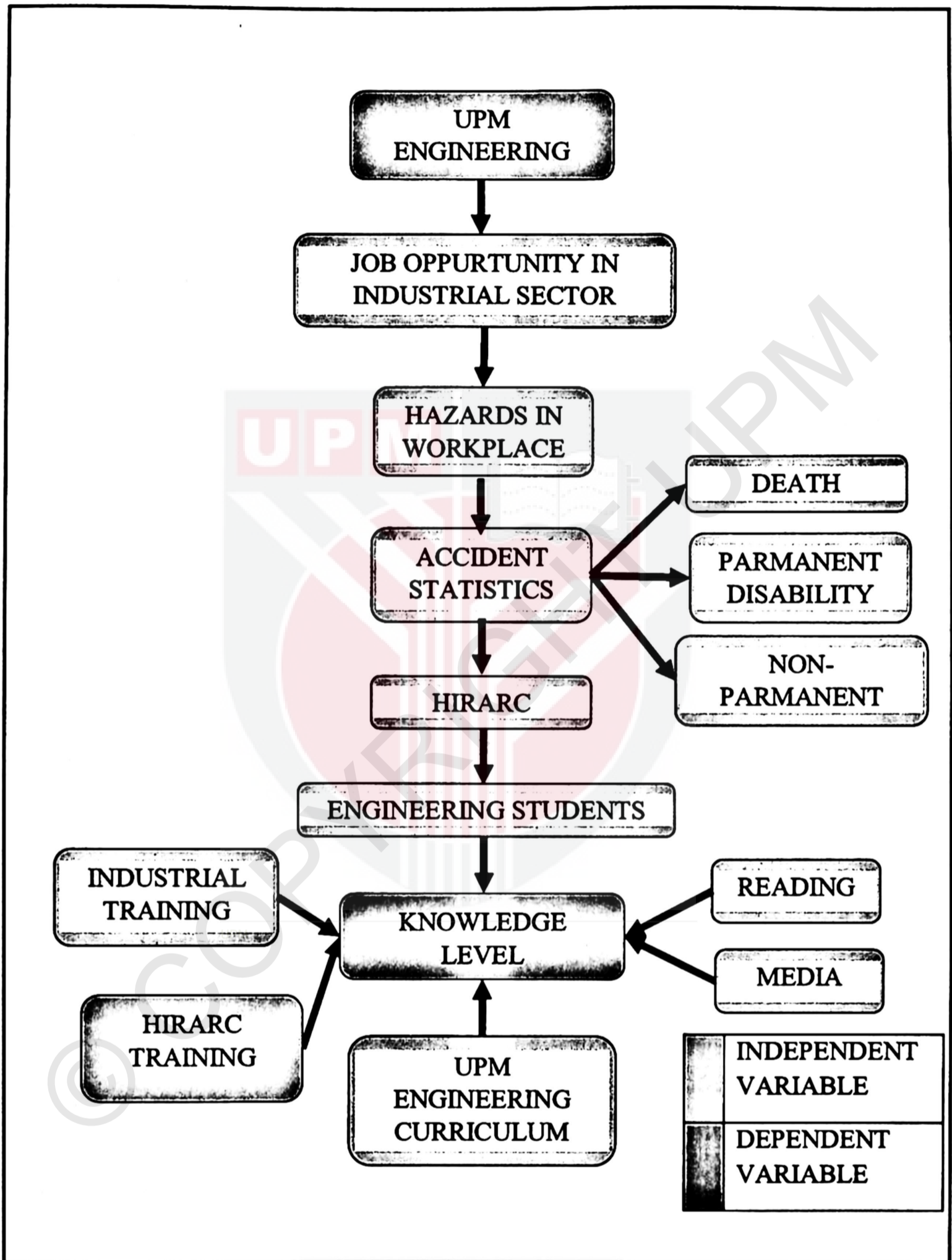


Figure 1.4.1 Conceptual framework

1.5 DEFINITIONS OF TERMS

1.5.1 CONCEPTUAL DEFINITION

ENGINEERING STUDENTS

Engineering students are a person that is able to deliver and communicate their design ideas to others. The students should have strong spatial visualization and different area of engineering covers different ways of designing and visualization skills (Sorby et al., 2013).

TRAINING

Training is a learning process that gives benefits to the workers, organizations and also the company. Training is considered effective when it would increase the use of time, costs, commitment and expertise or performance of the respondent (Fardaniah, Aziz, & Osman, 2019).

KNOWLEDGE

Knowledge is defined as an understanding of a community on a certain topic (Anees et al., 2014).

1.5.2 OPERATIONAL DEFINITION

ENGINEERING STUDENTS

The individuals that study in the 4th year at the Faculty of Engineering, UPM that are willing to be part of this study as a respondent. The respondent must have followed the inclusion and exclusion criteria.

TRAINING

Training on HIRARC was given in the form of lecture, brochure and video to the respondent. Both the lecture and the brochure will be adapted from the book Guidelines for HIRARC by DOSH Malaysia.

KNOWLEDGE

The engineering students' knowledge related to HIRARC will be analyzed in this study before and after the training was given. This study will assess the engineering student understanding on the lecture and brochure given.

1.6 RESEARCH OBJECTIVES

1.6.1 GENERAL OBJECTIVES

To measure the effect of training on knowledge level related to Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students

1.6.2 SPECIFIC OBJECTIVES.

- I. To identify the socio-demographic background of UPM engineering students.
- II. To develop a training module on basic Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students.
- III. To identify the knowledge level related to basic Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students.
- IV. To compare the knowledge level of Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students before and after the training.
- V. To determine the association between the knowledge level of Hazard Identification Risk Assessment and Risk Control (HIRARC) and sociodemographic background
- VI. To determine the association between the knowledge level of Hazard Identification Risk Assessment and Risk Control (HIRARC) and respondent's exposure towards Occupational Safety and Health (OSH) during their studies in UPM.

1.7 STUDY HYPOTHESIS

- I. There is a significant difference in knowledge level related to Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students before and after the training.**
- II. There is an association between the knowledge level of Hazard Identification Risk Assessment and Risk Control (HIRARC) and sociodemographic background**
- III. There is an association between the knowledge level of Hazard Identification Risk Assessment and Risk Control (HIRARC) and respondent's exposure towards Occupational Safety and Health (OSH) during their studies in UPM.**

CHAPTER 2

LITERATURE REVIEW

2.1 OCCUPATIONAL SAFETY AND HEALTH

According to Alli (2008), Occupational Safety and Health (OSH) is generally defined as the science of anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, considered the possible impact on the surrounding communities and the general environment. OSH in Malaysia has many kinds of standards and guidelines such as Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC), 2008, Guidelines on Occupational Safety and Health in the Service Sector, 2004 and many others. these guidelines, Codes of Practices were developed to provide at least minimum acceptable protection to the workers in relation with their work environment that may cause injury to them (Husin, 2014). Although many things have been done yet still most employers do not feel this issue an important thing for the success of a company (Ahmaddon, 2006).

Loses from an industrial accident can cause many bad impacts besides injury, illnesses or death. Brauer, (2006) stated that loses should include the loss of time, productions and sales and also considered the damage to the property, equipment, materials and the cost of repair and replacement. So, it is essential to prevent an accident

from the beginning of the process by eliminating unsafe acts and unsafe conditions. Heinrich has come out with a concept that focuses primarily on accidents and their causes rather than paying attention to the effects. He develops the 88: 10: 2 ratios after studying 75 000 accidents. 88% were caused by unsafe acts, 10% by unsafe conditions and 2 % by unpreventable causes. A study by the Pennsylvania Department of Labor and Industry also prove that both unsafe acts and conditions were the main contributors to 98% of the 80 000 industrial accidents analyzed. This ratio concludes that it is important for engineers to reduce or eliminates the unsafe acts and unsafe conditions to prevent minor or serious injuries from occurring.

2.2 HAZARD IDENTIFICATION RISK ASSESSMENT AND RISK CONTROL (HIRARC)

In 2008, the Department of Safety and Health (DOSH), Malaysia has made a Guideline on Hazard Identification, Risk Assessment and Risk Control (HIRARC). This guideline is useful for the industry to identify the hazard, analyze and assess its associated risk and then apply the suitable control measures. The Guideline is easy to use and is used widely by small and medium industries even in the manufacturing, construction and other sectors. According to Saedi, 2014 said that HIRARC does help especially for the implementation of safety and health in the operations.

Every work must concern with risk and hazards to make the environment of the work safer. Possible risk and hazards need to identify and assess to protect the safety, health and welfare of the workers and the working environment (Kasim et al, 2018). Managing the risk consist of hazard identification, assessment of risk, identification of risk control options as well as the evaluation, monitoring and review of the risk at the workplace. (Azuddin et al, 2013). This guideline can provide a systematic and objective approach to assess hazard and risk as well as a method to control the risk (DOSH, 2008).

2.3 ROLES OF ENGINEERS IN INDUSTRY

Engineers have a very broad occupation that can work in various place from the agricultural sector, electronic and even petroleum. The students who study in an engineering course can get a job as chemical engineers, mechanical engineers, civil engineers, electrical engineers and others. Ajmera (n.d.) discuss the job description of engineers as to collect data on products, process and others, they also will participate in meeting that will discuss on the company future plans, company problems and process that could be improved. In the other hand, from a website where the job can be fine online Snagajob.com describe engineers as an occupation that will make or develop a system for a process, improve the current systems and create new projects. The engineers were described to be creative, have good mathematical skills, communication skills and problem-solving skills. Students that pose all the criteria and requirement will easily get a job in the sector they want to.

According to Brauer (2006), among the top engineering discipline are civil engineering, mechanical engineering, electrical engineering and chemical engineering. Civil engineering focuses mainly on structural of buildings, bridges and other constructed facilities. This discipline also studies on the design and construction of facilities for railroads, motor vehicles and others. Next, mechanical engineering aims more on designing machines, boilers and pressure vessels, elevators and other kind of mechanized equipment and facilities. Moreover, Alyson (2018) describe electrical engineers design components that make power plants, cars, medical devices and computer runs. They apply electrical theory to a new device or circuit. Lastly, chemical engineer work on changing the chemical, biochemical and physical state of a substance to turn it into something else, such as making oil from plastic (Prospects.ac.uk., 2018).

According to the statistic from DOSH, the top three sectors that possess the highest risk until June 2018 is constructions, manufacturing and agriculture. These three sectors have a high number of deaths, permanent disability and non-permanent disability workers. Construction has a very complicated environment and different skilled workers that make this sector as a very risky industry (Le et al, 2014). Yet, construction cannot be stopped as it increases the country development. Furthermore, manufacturing sectors also one of the main sources of the country economic growth. Based on the Department of Statistics, Malaysia, almost 80% of total exports in Malaysia comes from manufacturing sectors and followed by agriculture. So, OSH is vital in every sector because if an accident could be reduced, compensation paid could also decrease thus generating higher returns (Surienty, 2012).

2.4 MALAYSIA ENGINEERING STUDENTS CURRICULUM

Most of the universities in Malaysia, public or private universities have engineering field because it is a high demand study, but each university has different course to offer. Generally, engineering courses offered by universities in Malaysia are electrical engineering, mechanical engineering, chemical engineering, and civil engineering. Basically, civil engineering will continue into the construction sectors, and the other engineering study will go into the manufacturing sector as well as the agriculture sector.

The engineering students' curriculum does not cover OSH fully. There is no course that teaches on OSH such as identifying hazard, risk assessment and control in the engineering curriculum. The core subject that most of the universities offer only touch a little bit on safety topics such as safety design in construction, safety criteria and others. Although there is a safety subject, it is an elective which the students can choose to take it or not. This is not full enough, and the students need to be taught deeper as they will enter the sector that has the highest death incidence. By learning the safety topic, they will have a bigger picture on how to implement the safety measure at their workplace.

2.5 HIRARC TRAINING

According to Oxford Dictionaries training is an act of teaching a particular skill or behavior. There are various ways of teaching methods available that sometimes involve one person and sometimes involve many persons such as lecturing, group discussion, presentations and many others. The best teaching method that most student like is the lecture method followed by group discussions. The lecture is rated as the best because the lecture usually is given by persons that have a high knowledge level of something, save time and easy (Sajjad, 2011). Teaching is a very effective method especially for complex topics as the instructors can answer specific questions because of their high knowledge in something (Vanry n.d.). Sajjad also explains that the lecture could be more interesting and meaningful if gesture, movement, facial expression and eye contact is added during the training sessions.

Next, group discussions involve more participants of students where they can change ideas among them. The learning will be more effective because the students participate actively in the learning process. A perfect discussion must be facilitated by instructors or facilitators to monitor the discussions and make sure everyone actively involves. Before the discussion starts the student should at least know and have information about the topic to be discussed to avoid the discussion to be meaningless. Among various method of training, students are likely with the lecture as it is easy and more convenient for them compare to other methods.

CHAPTER 3

METHODOLOGY

3.1 STUDY DESIGN

This is an interventional study in which a developed questionnaire was used to compare the knowledge level of Hazard Identification, Risk Assessment and Risk Control (HIRARC) among UPM engineering students before and after the training. The interventions consist of a module in the form of slide presentations and a questionnaire that was developed by the researcher and all the information were adapted from the book, Guidelines for Hazard, Identification, Risk Assessment and Risk Control (HIRARC) by DOSH Malaysia.

3.2 STUDY LOCATION

This study is carried out in the Faculty of Engineering, Universiti Putra Malaysia. UPM was chosen as the study location as it is a one of the best research university in Malaysia and their engineering subjects has been ranked among the best 100 in QS world University Ranking 2018 for the second year in a row.

3.3 STUDY POPULATION

The target population of this study is the 4th year engineering students from Faculty of Engineering, Universiti Putra Malaysia. The sampling frame of this study is the list of students that is in their 4th year of study in the engineering cost in Universiti Putra Malaysia regardless of the gender.

The target population must be a students who is currently an engineering 4th year students who is studying a degree in Faculty of Engineering, UPM for 4 years. This is to make sure they already study most of the engineering subject in UPM and they already attended the industrial training. The target population must exclude foreign students who does not understand English or Malay language as to avoid misunderstanding while conducting the training

3.4 SAMPLING METHOD

The sampling method used in this study was convenient sampling method. The final year students from the Faculty of Engineering, Universiti Putra Malaysia was chosen based on the inclusive criteria as well as the exclusive criteria.

3.5 SAMPLE SIZE CALCULATION

The sample size calculation was calculated using the mean for one group formula (Aday & Cornelius. 2006). The study aims to compare the knowledge level related to Occupational Safety and Health among UPM engineering students before and after the training.

$$n = \frac{Z^2_{1-\alpha/2} \sigma^2}{d^2}$$

Where:

n = Sample size

$Z^2_{1-\alpha}$ = Standard errors associated with confidence (95% of confidence interval which has 1.96 of standard errors)

σ = Estimated standard deviation (4.03)

d^2 = Desired precision (1% desired precision)

The sample size will be calculated as below:

$$n = \frac{1.96^2 \times 4.03^2}{1^2}$$

$$n = 62.39 \sim 62$$

The sample size calculated for this study is according to the previous study by Chéret et al., 2018. This previous study is chosen based on the 4.03 value of standard deviation calculated for respondent different perspective before and after the training.

Thus the sample size of the engineering student will be 62.39. However, another 10% of the sample size will be added in case of any likelihood of drop out respondents to occur.

$$\frac{10}{100} \times 62.39 = 6.239$$

$$62.39 + 6.239 = 68.629$$

Therefore, the total sample size required for this study after rounded of will be 69 respondents.

3.6 STUDY INSTRUMENT

I. QUESTIONNAIRE

There are two phases of the questionnaire which is the before the training and after the training. The questionnaire was in English language and consisted of two sections as below.

Section A: Socio-Demographic

In this section, there will be several questions asked such as gender, age, ethnicity, engineering course, industrial training sectors and past involvement of OSH training

Section B: Knowledge on Hazard Identification, Risk Assessment and Risk Control (HIRARC)

Knowledge survey was done to examine the respondents' knowledge of HIRARC information. This study was on Knowledge only as the Attitude and Practice was not practicable to the engineering student as they only apply the information when they were working. This study compared the current knowledge of the respondent's and the changes in knowledge after training on HIRARC has been done.

This section B was given two times which were before and after the training. The pre-intervention consisted of section A and B and was given in hardcopy. For post-intervention, consist of section B only and the respondents answered the questions by using an application name Kahoot. Kahoot is a quiz game used by many educational institutions because it is fun for the students and user-friendly by the teachers. After the game ends, this application will automatically summarize all the results and answers from the students to excel.

In this section, there were 20 questions asked to obtain the knowledge level of the engineering students. There will be 3 answers options which were Yes, No and Don't know. There was positive type of questions and negative type of questions. One score was given for each correct answer and 0 scores for each wrong and "don't know" answer. The scores will be range into three levels which was high level (71%-100%) or scores from 14 to 20, medium level (51%-70%) or scores from 10 to 13 and low level (less than 50%) or 0 to 9 (Anees et al., 2014).

II. TRAINING MODULE

The training module used in this study was a lecture and brochure on HIRARC. The lecture and brochure are developed by the researcher and the information are adapted from the book Guidelines for Hazard, Identification, Risk Assessment and Risk Control (HIRARC) by DOSH Malaysia. The training was given by the researcher right after the respondent answer the pre-intervention and the session was completed within one hour. To deliver the module effectively, the researcher had attend some courses related to presentation skills such as Academic Interaction and Presentation and Communication and Professional Development. The researcher also had also deliver the training module several time before giving it to the actual respondent. The lecture method was used than other methods because research made by Sajjad, 2011 concluded, students like the lecture method the most comparable to other methods. The brochure was given after the respondent answer the pre-intervention. This brochure was useful to the respondent as a guide and has information related to the lecture that was given.

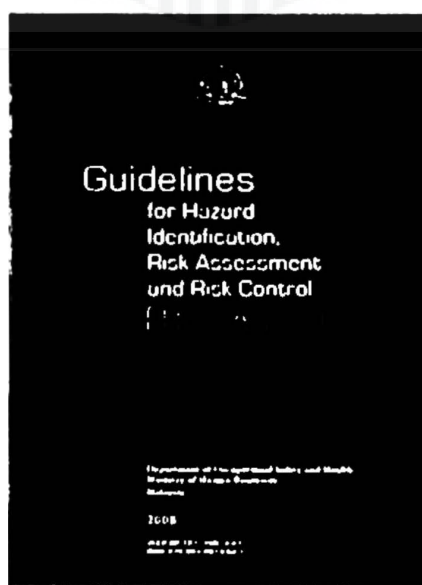


Figure 3.6.1 Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC) by DOSH Malaysia

The training consist of the following sub-topics:

1. Introduction Occupational Safety and Health (OSH)
2. Heinrich triangle
3. Hierarchy of control
4. Type of hazards
5. Hazard, Identification, Risk Assessment and Risk Control (HIRARC)



Figure 3.6.2 Training sessions

3.7 QUALITY CONTROL & QUALITY ASSURANCE

The questionnaire and training module used in this study was self-designed by the researcher based on Guideline on HIRARC book. This questionnaire and training module including the lecture and brochure were validated and reviewed by experts in OSH from the Department of Environmental and Occupational Health, UPM. This is to access if the questions are reliable and relatable with the study objectives. A pre-test which includes testing the questionnaire and the training module were conducted among a group of engineering student (10% from the study sample size) from the Faculty of Engineering, UPM as they had similar characteristics to the study populations. The researcher who delivered the raining module had already been thought on HIRARC by experts in OSH from the Department of Environmental and Occupational Health, UPM and had already been trained to practiced it in real workplace environment.

The value for internal consistency obtained through Cronbach's alpha was 0.629 for the knowledge level of HIRARC among UPM engineering students. Based on the study by Ahdika, 2017, Cronbach's alpha score between 0.6 to 0.8 was considered as reliable. They were also asked on the unclear term for the questionnaire and the training module so that the researcher can improve before giving it to the real sample population. The result from the pre-test will not be included in the result of the study.

3.8 STUDY FLOWCHART

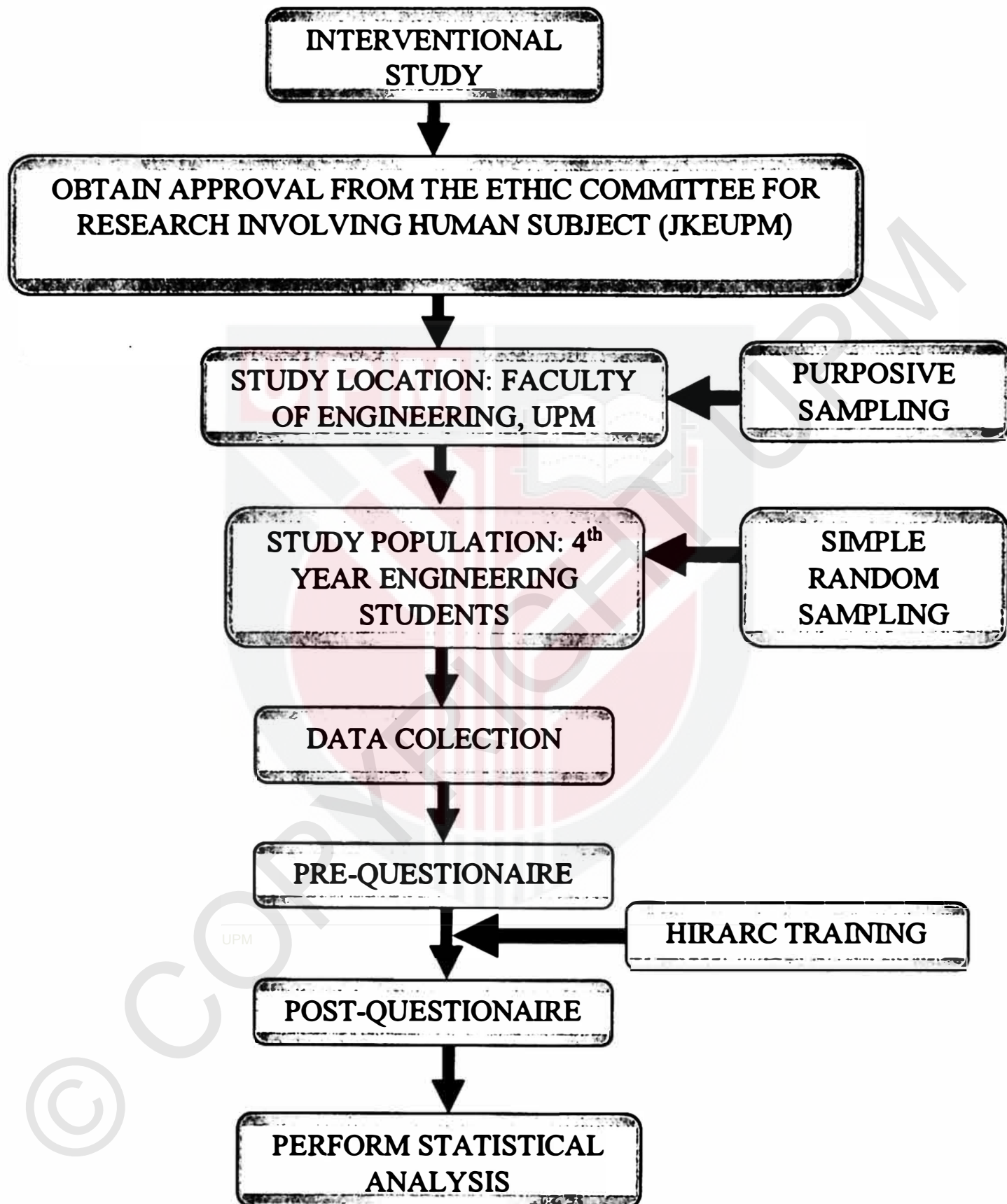


Figure 3.8.1 Study flow chart

3.9 DATA AND STATISTICAL ANALYSIS

The results for the socio-demographic data were analyzed using descriptive analysis. Descriptive analysis was also used to identify the knowledge level related to HIRARC among engineering students. Comparison between the knowledge level related to Hazard Identification, Risk Assessment and Risk Control (HIRARC) among UPM engineering students before and after the training was analyzed using Wilcoxon signed ranks test. All the data obtained in this study will be analyzed using Statistical Package for the Social Science (SPSS) Version 25.

3.10 ETHICAL CONSIDERATIONS

This study had obtained ethical approval from the Ethics Committee of Universiti Putra Malaysia (UPM), Selangor, Malaysia as this research involve human. The ethical approval reference number was UPM/TNCPI/RMC/1.4.18.2. Written consent was obtained from the respondents prior to the study and the instruction about the questionnaire was explained to the respondents during filling up the questionnaire. All information obtained from the respondents were kept private and confidential and used for study purposes only.

CHAPTER 4

RESULTS

4.1 Socio-demographics

This study involved 70 respondents comprise of 38 (54.3%) males and 32 (45.7%) females from three different courses which were 28.6% (n=20) Civil Engineering, 38.6% (n=27) Agricultural and Biosystem Engineering and 32.9% (n=23) Mechanical Engineering. Most of them were 62.8% (n=44) is below 23 years old, 17 (24.3%) of them aged between 24 to 25 and 9 (12.9%) of them are 26 and above. The races were divided into two major groups. A total of 60 (85.7%) of them were Malay and another 10 (14.3%) of them were from other races such as one Chinese, four Indian, two Iban, one in each Dusun, Bajau and Rungus. in terms of CGPA, 17.1% (n=12) of them got between 3.501 to 4.000, 47 (67.1%) or most of them in between 3.000 to 3.500 while the other 15.7% (n=11) of them had CGPA below 3.000. Lastly, almost half of the respondent which was 41 (58.6%) of them came from National secondary school, 4.3% (n=3) of them from Secondary school, 11.4% (n=8) from Technical or Vocational secondary school, 2.9% (n=2) were from National Religious Secondary School and 16 (22.9%) were from Fully Residential school. Table 4.1.1 describes the socio-demographic background of engineering students in UPM.

Table 4.1.1 Socio-demographic background of engineering students in UPM. (n=70)

Variables	Items	N=70	
		Frequency (%)	Mean (SD)
Gender	Male	38 (54.3)	
	Female	32 (45.7)	
Age	<23	44 (62.8)	
	24-25	17 (24.3)	23.76 (1.31)
	>26	9 (12.9)	
Courses	Civil Engineering	20 (28.55)	
	Agricultural and Biosystem Engineering	27 (38.55)	
	Mechanical Engineering	23 (32.90)	
Race	Malay	60 (85.7)	
	Others	10 (14.3)	
CGPA	<3.000	11 (15.7)	
	3.000-3.500	47 (67.2)	
	3.501- 4.000	12 (17.1)	

	National Secondary School	41 (58.6)
	Secondary School	3 (4.3)
School	Technical or Vocational Secondary School	8 (11.4)
	National Religious Secondary School	2 (2.9)
	Fully Residential School	16 (22.8)

For their exposure towards OSH during their studies in UPM. Firstly, for the industrial training factors, 14 (20.3%) of them went for industrial training in the manufacturing sector, 22 (31.9%) went into the construction sector, 18 (26.1%) of them did their industrial training in the agriculture sector and 16 (21.7%) of them went to other sectors such as four in oil and gas sector, five in consultant, two in aquaculture sector, each one in power plant station, software and technology sector and oleochemical sector and lastly two in government sector.

Half of the respondents had already attended training related to Occupational safety and health. Some of the training attended by the respondents are 13 respondents attended Construction Industry Development Board (CIDB), three in each BASF Petronas, oil refinery training, *Cardiopulmonary resuscitation* (CPR) training, seven got into Occupational Safety and Health seminar, two in Blue card training and four into inert entry training. The other 50% (n=35) respondents have not attended any training related to OSH.

Besides that, when being asked which sector they wish to work in the future, 26.1% (n=18) of them wish to work in the manufacturing sector, 30.4% (n=20) wished to work in the construction sector, 26.1% (n=17) in the agriculture sector and another 17.4% (n=15) wished to work in other sectors such as one wanted to continue in aviation, three in each oil and gas sector and management, four in consultant and lastly two in each both business and oleochemical sector.

Lastly, when being asked to rate their perception in the knowledge level related to OSH, 5 (8.8%) of them think they had very good knowledge on OSH, followed by 54.4% (n=39) thought they have a good level of knowledge on OSH. A total of 35% (n=18) of them were not sure and 7 of them rate themselves as low. Lastly, one of them thought of having very low knowledge related to Occupational safety and health. Table 4.1.2 shows Engineering student's exposure towards safety during their studies in UPM.

Table 4.1.2 Engineering student's exposure towards OSH during their studies in UPM. (n=70)

Variables	Items	N=70	
		Frequency	Percentage (%)
Industrial training sector	Manufacturing	14	20.3
	Construction	22	31.9
	Agriculture	18	26.1
	Others	16	21.7
Training attended related to OSH	No	35	50.0
	Yes	35	50.0
Sector wish to work in the future	Manufacturing	18	26.1
	Construction	20	30.4
	Agriculture	17	26.1
	Others	15	17.4
Perception of own knowledge related to OSH	Very low	1	1.5
	Low	7	10.3
	Not sure	18	25.0
	Good	39	54.4
	Very good	5	8.8

4.2 Overview of respondents' answer on the knowledge level of HIRARC for the pre and post-intervention.

The questionnaire that was used to evaluate the knowledge level of HIRARC among engineering students consists of 20 questions. All the questions used in the questionnaire had already been included and thought during the training sessions. To evaluate the increase in knowledge the same questions were used for the pre and post-intervention. Table 4.2.1 shows the choices answer by the respondents for the pre and post-intervention.

Table 4.2.1 Overview of respondents' answer on the knowledge level related to HIRARC for the pre and post-intervention. (n=70)

No.	Questions	Frequency (%)			
		Pre-intervention		Post-intervention	
		Correct	Wrong	Correct	Wrong
1	HIRARC is important to ensure that risks at the workplace are adequately controlled at all times.	69 (98.6)	1 (1.4)	70 (100)	0 (0)
2	The machine design has nothing to do with an accident that happens in the workplace.	62 (88.6)	8 (11.4)	68 (97.1)	2 (2.9)
3	Heinrich concludes that for every one major injury there is 27 accident that causes minor injury.	2 (2.9)	68 (97.1)	38 (54.3)	32 (45.7)

4	HIRARC can only be done by the Safety and Health Officer in a company.	13 (18.6)	57 (81.4)	61 (87.1)	9 (12.9)
5	HIRARC provides a systematic and objective approach to assess the hazard.	60 (85.7)	10 (14.3)	66 (94.3)	4 (5.7)
6	It is not necessary to keep a record on the hazard that has been identified.	61 (87.1)	9 (12.9)	63 (90.0)	7 (10.0)
7	A new machine that already has guard installed does not need HIRARC to be done.	61 (87.1)	9 (12.9)	65 (92.9)	5 (7.1)
8	Doing maintenance to machine breakdown is consider as routine work.	16 (22.9)	54 (77.1)	25 (35.7)	45 (64.3)
9	Hazard is the process of evaluating risks to safety and health arising from hazards at work.	10 (14.3)	60 (85.7)	20 (28.6)	50 (71.4)
10	Using first aid record is one of the techniques to identify hazards.	53 (75.7)	17 (24.3)	48 (68.6)	22 (31.4)
11	A near miss that occur in the workplace needs to be reported to the employer or line leader.	67 (95.7)	3 (4.3)	63 (90.0)	7 (10.0)
12	Hazards are divided into five main groups-health, biological, physical, chemical and ergonomic.	1 (1.4)	69 (98.6)	15 (21.4)	55 (78.6)
13	Bullying is classified under the physical hazard.	14 (20.0)	56 (80.0)	49 (70.0)	21 (30.0)
14	Risk is a combination of likelihood and severity.	59 (84.3)	11 (15.7)	63 (90.0)	7 (10.0)

15	Implement short-term measures to protect workers until permanent controls can be put in place	55 (78.6)	15 (21.4)	64 (91.4)	6 (8.6)
16	Control measured for low risk may not be necessary to be done.	6 (8.6)	64 (91.4)	13 (18.6)	57 (81.4)
17	Safety device must be installed when the hazard cannot be eliminated or reduce completely.	57 (81.4)	13 (18.6)	64 (91.4)	6 (8.6)
18	Elimination is the most practicable control to be used by the employer.	13 (18.6)	57 (81.4)	52 (74.3)	18 (25.7)
19	Putting a barrier to protect workers from hazards is one of the administrative controls.	17 (24.3)	53 (75.7)	42 (60.0)	28 (40.0)
20	Medium risk requires immediate action to be done to control the hazard.	4 (5.7)	66 (94.3)	25 (35.7)	45 (64.3)

4.3 The knowledge level related to HIRARC for the pre and post-intervention among engineering students in UPM

The scores were then categorized into three levels of knowledge which were high, medium and low. The data clearly showed in table 4.3.1 the increase of knowledge after the training was given to the engineering students. For the pre-intervention, 70% (n=49) of the respondents were categorized to have medium knowledge on HIRARC and no respondent got a high level of knowledge. However, after the training was given 45 (64.3%) respondents were categorized to have a high level of knowledge of HIRARC with no respondents got categorized into the low level of knowledge.

4.3.1 Level of knowledge of HIRARC for the pre and post-intervention among engineering students in UPM. (n=70)

Level of knowledge	Pre-intervention	Post-intervention
	Frequency (%)	
High	0 (0.0%)	45 (64.3%)
Medium	49 (70.0%)	25 (35.7%)
Low	21 (30.0%)	0 (0.0%)

4.4 Knowledge level of HIRARC among UPM engineering students before and after the training.

Wilcoxon signed ranks test was used instead of paired t-test because of the normality test for the data obtained is not normal. This test showed a significant result as the p-value was below 0.05. Table 4.4.1 shows the results of the Wilcoxon signed ranks test among UPM engineering students.

Table 4.4.1 Comparison of the median on the knowledge level of HIRARC among UPM engineering students before and after the training. (n=70)

Median (IQR)		z	p-value*
Knowledge before	Knowledge after		
10 (9-11)	14 (13-15)	-6.612	*0.0001

*p-value significant at 0.05 level

4.5 Association between knowledge level of HIRARC for the pre-intervention and the respondent's socio-demographic background

Chi-square test was used to test the association between respondent's knowledge level of HIRARC for the pre-intervention and the age of the respondents. A significant result was shown as the p-value and the Fisher's Exact Test value is below 0.05. Table 4.5.1 showed the result of the association between both of them. Respondents at the age of 23 and below had the highest number to get the low and medium level of knowledge.

Chi-square test was used to test the association between respondent's knowledge level of HIRARC for the pre-intervention and the gender of the respondents. No significant result was shown as the p-value is above 0.05. The result of the association between both of them. Male respondents showed the highest number in the low knowledge level while female respondents showed the highest number of medium knowledge level.

Table 4.5.1 The association between knowledge level of HIRARC for the pre-intervention and the respondent's socio-demographic background. (n=70)

Variable	Level of knowledge, n (%)		X ² (df)	p-value*
	Low	Moderate		
Age				
<23	17 (38.6)	27 (61.4)		*0.042
24-25	1 (5.9)	16 (94.1)	6.319 (2)	(0.028, Fisher's Exact Test)
>26	3 (33.3)	6 (66.7)		
Gender				
Male	14 (36.8)	24 (63.2)	1.853 (1)	0.173
Female	7 (21.9)	25 (78.1)		

*p-value significant at 0.05 level

4.6 Association between knowledge level of HIRARC for the pre-intervention and respondent's exposure towards OSH during their studies in UPM.

Chi-square test was used to test the association between respondents' knowledge level of HIRARC for the pre-intervention and the type of industrial training taken by the respondents. No significant result was shown as the p-value and the Fisher's Exact Test value was above 0.05. Table 4.6.1 showed the result of the association between both of them. Engineering students that had their industrial training in the Construction sector had

the highest number in the medium knowledge level of HIRARC while students that done their industrial training in Others sector had the highest number in the low knowledge level of HIRARC.

Chi-square test was used to test the association between respondents' knowledge level of HIRARC for the pre-intervention and the training related to OSH attend by the respondents. There was no association shown as the p-value is above 0.05. The result of the association between both of them. The respondents who got a medium level of knowledge was higher for those who had attended training. Respondents that did not attend the training score higher for the low knowledge level than those who attend the training.

Chi-square test is used to test the association between respondent's knowledge level of HIRARC for the pre-intervention and the perception of own knowledge related to OSH of the respondents. There was no significant result as the p-value and the Fisher's Exact Test value is above 0.05. Result in table 4.6.1 showed the association between both of the variable. One respondent who thinks they had a very low level of knowledge on OSH got medium knowledge level on HIRARC. Respondents that got low knowledge level of HIRARC is the highest for the respondent that are not sure about their knowledge on OSH.

4.6.1 Association between knowledge level of HIRARC for the pre-intervention and respondent's exposure towards OSH during their studies in UPM. (n=70)

Variable	Level of knowledge, n (%)		X ² (df)	p-value*
	Low	Moderate		
Type of industrial training				
Manufacturing sectors	4 (28.6)	10 (71.4)	2.051 (3)	0.562 (0.583, Fisher's Exact Test)
Construction sectors	5 (22.7)	17 (77.3)		
Agriculture sectors	5 (27.8)	13 (72.2)		
Other sectors	7 (43.8)	9 (56.3)		
Training attended related to OSH				
Yes	10 (28.6)	25 (71.4)	0.068 (1)	0.794
No	11 (31.4)	24 (68.6)		
The perception of own knowledge related to OSH				
Very low	0 (0.0)	1 (100.0)	3.352 (4)	0.476, Fisher's Exact Test)
Low	2 (28.6)	5 (71.4)		
Not sure	8 (44.4)	10 (55.6)		
Good	9 (23.1)	30 (76.9)		
Very good	2 (40.0)	3 (60.0)		

*p-value significant at 0.05 level

CHAPTER 5

DISCUSSION, CONCLUSION, RECOMMENDATION AND LIMITATION

5.1 Introduction

The knowledge level Of HIRARC was identified before and after the training was given to the respondent. 70 respondents from three different engineering courses participated in this study. This study determined the effect of training on the respondent's knowledge and to find the association between knowledge on HIRARC and the respondent's socio-demographic data and their exposure towards OSH. OSH is a wide field that comprises various scopes such as Emergency Response Plan, Safety Committee, HIRARC and others. For the students who will be entering the working sectors, they must have some basic on OSH. HIRARC is a simple tool and one of the basic safety tools that might help to protect the students from the hazard at work.

This is the first study that finds the effect of training on HIRARC on the student's knowledge level reported within our knowledge and so far literature showed that such study has been done among the workers in the industries, radiation facilities sector and construction site only (Kasim et al., 2018) and (Saedi et al, 2014). Most of the study related to this topic done in Malaysia focuses on the workers and have neglected the young people

who will enter the working sectors. This study can be the baseline for the government to evaluate the current student knowledge level on HIRAC and can prepare the students before entering the working sectors.

5.2 Socio-demographics background of UPM engineering students

The male respondents were the majority compared to the female. The youngest respondents are 22 years old and the oldest is 28 years old. For the requirement of entering the engineering study, it did not specify the age to enter the course. Most of the students came from three different backgrounds which were foundation students, matriculation students and diploma students. According to table 4.2.1., the respondents came from three different engineering courses which are Civil Engineering, Agricultural and Biosystem Engineering and Mechanical Engineering. These three engineering courses were selected because of their high risk of accident that might happen at the workplace.

This was supported based on the statistics issued by DOSH until October 2018 which was the construction sector has the highest number of deaths followed by manufacturing and agriculture (DOSH, 2018). Each work sector had its own level of risk and the employer must make sure as far as practicable the safety, health and welfare of the employee at work. The OSH Act 1994 also emphasize on section 20 that a person who design or manufactures any plant must make sure the design is safe and without risk to health.

Even in the agricultural sector, the safety and health element had become a requirement for the farmers to apply for incentives. The farmers must have been registered for MyGAP which stands for Malaysia Good Agricultural Practice which focuses on the quality of food, to reduce pollution and also to make sure the safety and welfare of persons at work (MOA, 2013). To apply for the MyGAP certification, the farmers must comply with all 16 of the requirements. Some of the requirements are to keep the safety, health and welfare of the workers, to have good sewage systems and the plant activities must follow all laws applicable in Malaysia.

The respondents have done their industrial training sector in the manufacturing sector, construction sector, agriculture sector and also other sectors such as oil and gas, consultancy, aquaculture, power plant station, software and technology sector, oleochemical sector and lastly government sector. It is compulsory for all the engineering students to do their 10 weeks of Industrial training in their sixth semester during the end of their third year to complete the five credits Industrial Training courses and as the requirement by the university for the students to graduate. Each sector had its own risk of an accident. So, HIRARC will be beneficial to the company as it can reduce the risk of accident, increase people trust, financial and the most important worker's health.

Moreover, 50% (n=35) of the respondents had attended training related to OSH and another half of them had never attended training related to OSH. OSH related training is important for a person before they go into the working sector. This is because each

worker is exposed to many hazards at the workplace depending on the type of their work. Some of the respondents went for the training as the requirement before they went to the industrial training and some others want to learn new things related to safety. The example of the training is the Construction Industry Development Board (CIDB) which focus on facilitating the construction industry. BASF Petronas which is training before entering the oil and gas sector. Next, oil refinery training which is quite the same as BASF Petronas training and focus more downstream such as crude oil, distillation and others. after that the Cardiopulmonary Resuscitation (CPR) training that teach early things to do if accident happens before the ambulance arrives, Occupational Safety and Health seminar which is a seminar that often organized by the faculty of engineering. Blue card training is done to improved safety performance in the transportation industry and lastly, inert entry training that trains people on safety before going into inert space.

When the respondent was asked about their perception of own knowledge level of OSH, more than half agree that they have good knowledge of OSH. This may due to the fact that they thought they have learned safety through these three stages which are firstly they may have learned during their studies. Based on the Undergraduate Study Programme Hand Book Academic Session 2018/2019 the core courses that they have taken were Safety and Risk Assessment and OSH in processing industries. Next, half of the respondent had already gone to the training which comprises many areas. Lastly, the students may get the knowledge and experience of safety during their industrial training. Workers that know how to implement OSH can prevent the accident from happening (Zakaria, 2012). Low experience and knowledge of worker are one of the main reason

new workers were getting occupational accident (Rodrigues et al., 2018). Lastly, most of them think they have good knowledge related to Occupational safety and health.

5.3 Overview of respondents' answer on the knowledge level of HIRARC for the pre and post-intervention.

From these 20 questions, most of the respondent had chosen the correct answer for the post-intervention compare to the pre-intervention which means there was an increase in their knowledge level. Based on table 4.4.2, here were two questions that get higher correct answer in the pre-intervention compared to the post- intervention which is question 10 and 11. The small decrease in number of the correct answer means that some of the respondents may have misunderstood the information obtained during the training. Some of the questions asked about the basic information on OSH but only a little of them got the correct answer in the pre-intervention. The basic OSH about the Heinrich theory got more than 90% wrong answer and the person who can do HIRARC question got more than 80% wrong answer.

Their pre-intervention only scores within five to 13 marks which are categorized as low and moderate. This was against their perception as more than half of them agreed to have good knowledge of OSH. They claim that they had learns Hazard and Operability Study (HAZOP) which is a more complicated tool than HIRARC but yet their score before training was still low. HAZOP is a tool that identified hazard and danger that might

happen during the process of the machine. This may because of the lack of revision which made them tend to make mistakes in choosing the correct answer.

5.4 Comparison of the median on the knowledge level related to HIRARC among UPM engineering students before and after the training.

Wilcoxon signed ranks test was used because the scores for the respondent's correct answer is not normally distributed. According to table 4.4.1, this study reported a significant result when knowledge level related to HIRARC among UPM engineering students is compared before and after the training. Thus, the hypothesis for this objective is accepted. The training module was proven to be effective as the knowledge of the respondents had increased through the training.

The training used simple words that can make the students easily understand the content of the training module. The used of pictures, figures and some examples helped the students understand the information in the training module. This knowledge will be useful for the respondent to be used in their work sectors in the future. This is supported with a study that shows training improves skills, performances and grades of engineering students (Sorby et al, 2013). The students can learn new things and at the same time can share the information with their colleague. Training on safety must be done continuously as safety cover a very wide aspect. Training that was done will reduce the risk of workplace accident from occurring (Zakaria et al, 2012).

5.5 Association between knowledge level of HIRARC for the pre-intervention and the respondent's socio-demographic background.

Chi-square test was used to find the association between two categorical data which was between knowledge level of HIRARC for the pre-intervention and the respondent's socio-demographic background which is age and gender.

Firstly, for the association between the knowledge level of HIRARC for the pre-intervention and the age of the UPM engineering students according to table 4.5.1, the p -value obtained was significant. Thus, the hypothesis for this objective was accepted. The age of the respondent varied from 22 to 28 years old. The respondents came from different study background such as matriculation, diploma and vocational. Some of the respondents may have been working before they continue their study. The data showed that more older people got moderate level than young people which mean older people tend to have more knowledge and experience (Karunamoorthi & Husen, 2012).

Secondly, the chi-square test was run to find the association between the knowledge level of HIRARC for the pre-intervention and the gender of the UPM engineering students. The result shows that there was no association between the knowledge level of HIRARC for the pre-intervention and the gender of the UPM engineering students and the hypothesis had been rejected. The result for the gender was almost the same where 24 (34.3%) for males and 25 (35.7%) for females got a moderate

level of knowledge Female was well known to have good memorization skill and male more to logical thinking skill (Sorby et al., 2013). This result showed that females had a slightly higher knowledge than male although the number of male respondents was higher than female. A study by Karunamoorthi and Husen, 2012 also did not find any association between knowledge and gender.

5.6 Association between knowledge level of HIRARC for the pre-intervention and respondent's exposure towards OSH during their studies in UPM.

Next was to find the association between knowledge level of HIRARC for the pre-intervention and the types of industrial training taken, training attended related to OSH and perception of own knowledge related to OSH of the UPM engineering students as shown in table 4.6.1.

Firstly, the association between the knowledge level of HIRARC for the pre-intervention and the type of industrial training taken by the UPM engineering students. The result was not significant. Respondents that did their industrial training in the construction sector had the highest moderate level of knowledge. The other sector had the highest respondent to get a low level of knowledge for the pre-intervention. According to the information from DOSH, until October 2018 the highest death being investigated was construction sectors followed by the manufacturing sector and lastly agriculture sector. This showed that the construction sector had the highest risk of accident and this sector

should have the best safety practice. This result proved that a respondent that had their industrial training in the construction sector have higher knowledge than other sectors. If a workplace practice safety climate the accident rate will decrease. (Fardaniah et al., 2019). Moreover, in the UPM engineering students course synopsis, it does not clearly state that the students will be exposed to the safety and health experience during the internship. Although the students may already get the safety knowledge during their studies, they cannot apply it during their internships. These five credits course more focus on giving the real working environment and improve the student's communication skills which may be the reason of no association between knowledge level of HIRARC for the pre-intervention and the type of industrial training taken by the UPM engineering students.

Next, there was no significant for the association between knowledge level of HIRARC for the pre-intervention and the training related to OSH attended by the UPM engineering students. Thus, the hypothesis is rejected. There should be a difference in the level of knowledge for the people that had attended OSH related training, but the result showed only a slight difference of one person for the low and moderate level of knowledge. This showed that the training that they had attended did not affect their knowledge level. Their studies at the university may contribute to the safety knowledge of the respondent. Most of the respondent went for compulsory training which they need to go before entering their industrial training. A study by Fardaniah et al., 2019 showed that compulsory training may not be effective in increasing safety knowledge. This is because some of the compulsory training given does not suitable for the workers to practice it. They cannot practice the knowledge they got from the training.

Lastly, there was no association between the knowledge level of HIRARC for the pre-intervention and the perception of own knowledge related to OSH of the UPM engineering students. The hypothesis for the last objective was also rejected. One respondent that thought to have a very low level of knowledge got the same level with respondent that think they have good and very good knowledge level which is a moderate level. The respondents that thought they had good and very good knowledge level should get a high level of knowledge of HIRARC. Both of this group must have gotten the safety knowledge during their studies, training, on the internet or in their industrial training.

5.7 Conclusion

Overall, this study found that the training module was effective in increasing the knowledge level related to HIRARC. The post-intervention score showed an increase of knowledge level by the respondent. For the pre-intervention, 70% (n=49) of respondents were categorized having medium knowledge on HIRARC and no respondent got a high level of knowledge, but after the training the result increase to 45 (64.3%) respondents categorized to have a high level of knowledge of HIRARC without any respondents categorized into the low level of knowledge. This prove that training can help in rising awareness among the student thus reducing the possibility of accident from happening at work.

This study also reported a significant result on the association between the knowledge level of HIRARC for the pre-intervention and the age of the UPM engineering students. Older people tend to have more knowledge than young people as they may have more expreince in education or work. However, there was no association between knowledge level of HIRARC found for the other remaining objectives which are gender, type of industrial training taken, training attended by the respondent related to OSH and lastly the respondent's own perception on their knowledge towards OSH. Engineering students nowadays must be equip with safety knowledge as the world now is developing very fast with new challenges appear everyday. With safety knowledge the safety in industrial sector will be better in the future for all the workers.

5.8 Recommendations

Based on the result, the study would recommend in the future to consider taking the respondent from all the engineering courses and do a stratified sampling to take representatives from each of the courses. This will increase the sample populations of the study. Next, the study could divide the respondent into two groups. One who will answer the questionnaire without training is given and another one answering the questionnaire after the training was done. Moreover, the engineering department may consider to revise the industrial training courses by inserting industrial safety as one of the topics to learn during their industrial training in the next revision of engineering curriculum. Different company or factory have different kind of safety implementation that might widen up the students view towards safety. Finally, this study only find the effect in short period of time, which is immediately after the training. Thus, the real effect may not sufficiently access the knowledge on HIRARC. The post-intervention should be given to the respondents after a few days of the intervention to access the real understanding of the engineering students on HIRARC.

5.9 Limitation

The limitation of this study was the student's participation. It is hard to get the participant as the students were in their final year. Most of them were busy collecting data for their projects and they also have fewer class to attend. It is hard to find free times to reach the participants. Moreover, this study only focus to develop a module on HIRARC. It is hard to determine the knowledge on OSH as it must cover many things such as Emergency Response Plan (ERP), First aid and others. Occupational Safety and Health (OSH) is a very wide scope and HIRARC is one of the main subtopics in it that is important for the respondent to know.

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APPENDIX 1

**Ethical approval from the Ethics Committee of
Universiti Putra Malaysia**

**ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA**

Research title	: The Effects of Training on the knowledge Level of Occupational Safety and Health (OSH) Among Engineering Students in Universiti Putra Malaysia
Study Site	: UPM
JKEUPM Ref No.	: JKEUPM-2018-385
Researcher	: Muhammad Zai Hazmi bin Abdul Halim
Supervisor	: Assoc Prof. Dr. Emilia Zainal Abidin

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 29/10/2018
2. Respondent Information Sheet & Consent (English), Version 2 dated 4/1/2019
3. Respondent Information Sheet & Consent (Malay), Version 2 dated 4/1/2019
4. Proposal (English), Version 2 dated 2/12/2018
5. Questionnaires/ Interviews (English), Version 1 dated 29/10/2018
6. Questionnaires/ Interviews (Malay), Version 1 dated 29/10/2018
7. Curriculum Vitae of:
 - a. Assoc Prof. Dr. Emilia Zainal Abidin

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

- Approved
- Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research
- Disapproved

Please note that the approval is VALID UNTIL 10 JANUARY 2020

Researchers should comply with the following:

- I. Complete a Study Final Report upon study completion (Form 3.2).
- II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white design with a book in the center, a banner at the top with the letters 'UPM', and a stylized 'U' and 'P' on the sides. The shield is set against a light background.

APPENDIX 2

**Acknowledgement from the Deputy Dean of
Undergraduate Studies, Faculty of Engineering,
Universiti Putra Malaysia**

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UPM

Lampiran 1

Butir-butir pelajar dan Projek Ilmiah Tahun Akhir yang akan dijalankan adalah seperti berikut

Butir-butir pelajar	
1) Nama	: Muhammad Zal Hazmi bin Abdul Halim
2) No. Matrik	: 181863
3) No. Tel	: 013-403 5548
4) Emel	: mzalhalim@gmail.com
5) Tajuk kajian (HIRARC)	: <i>The effect of training on knowledge level of Hazard Identification, Risk Assessment and Risk Control among engineering students in UPM</i>
6) Tempoh Penyelidikan	: 26 Oktober 2018 – 30 April 2019
7) Bilangan responden	: 70 responden
8) Bahan / Alatan kajian	: borang soal selidik



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APPENDIX 3

Consent form

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UNIVERSITI PUTRA MALAYSIA

**JAWATANKUASA ETIKA UNIVERSITI UNTUK
PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA**

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE :

The Effects Of Training On The Knowledge Level Of Hazard Identification Risk Assessment And Risk Control (HIRARC) Among Engineering Students In Universiti Putra Malaysia

2. INTRODUCTION:

Engineering is a branch of science and technology that concerned with designing, building with the use of engines, machines and structures based on Oxford dictionaries. Engineers play a key role in making sure that the design machine follow the safety aspect require. Although most machine built is already equipped with safety control such as guard, sensor and others however, accident still occur because of other factor such the system, the place of machine, surrounding and the workers behavior. Engineers with HIRARC knowledge could help eliminate the hazard from the designing phase, thus might reduce the probability of accident from occur. This study will aim to measure the effects of training on knowledge level related to Hazard Identification Risk Assessment and Risk Control (HIRARC) among UPM engineering students.

3. WHAT WILL YOU HAVE TO DO?

Sign the consent form with assumes your interest in this study after you read and understand all explanation given. The questionnaire needs to be answered and it will cover the respondent's socio-demographic and the respondent's knowledge level related to Hazard Identification Risk Assessment and Risk Control (HIRARC). The participation is voluntary, and that participant may withdraw anytime without penalty or loss benefit to which the participant entitled.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

The engineering students who are not in 4th year and not study in UPM. Respondents that have hearing problem and do not understand english or malay language also should not participate in the study.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

This study will provide training on HIRARC to the respondents. The respondent will get the information of HIRARC that is related to the engineers. This knowledge is needed to the respondents as it can be use when there are working as an engineer in the future.

(b) TO THE INVESTIGATOR?

This study will help to assess the level of knowledge of HIRARC among engineering students in Malaysia. This study can also be made as baseline on the present engineering students' in UPM HIRARC knowledge level.

6. WHAT ARE THE POSSIBLE RISKS?

There is no possible risks available in the study

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

The information of the respondent will remain confidential and will not be exposed to any parties. Consent from the participant is needed if information needs to be used outside of this study.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any additional questions during this course of research, you may contact a supervisor of this study Associate Professor Dr. Emilia Zainal Abidin at 013-304 2644 (za_emilia@upm.edu.my) or researcher of this study, Muhammad Zal Hazmi bin Abdul Halim at 013-4035548 (mzalhalim@gmail.com).

Please initial here if you have read and understood the contents of this page _____

9. CONSENT

I Identity Card No.
address.....

.....hereby voluntarily agree to take part in the
research stated above *(clinical /drug trial/video recording/ focus group/interview-based/
questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature Signature
(Respondent) (Witness)

Date :..... Name :.....
I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date Signature
(Researcher)



APPENDIX 4

Questionnaire

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Date/Tarikh:

ID No.:



QUESTIONNAIRE/BORANG KAJI SELIDIK

RESEARCH TITLE/TAJUK KAJIAN

THE EFFECTS OF TRAINING ON THE KNOWLEDGE LEVEL OF HAZARD IDENTIFICATION RISK ASSESSMENT AND RISK CONTROL (HIRARC) AMONG ENGINEERING STUDENTS IN UNIVERSITI PUTRA MALAYSIA / KESAN LATIHAN BERKENAAN TAHAP PENGETAHUAN PENGENALPASTIAN HAZARD, PENILAIAN RISIKO DAN KAWALAN RISIKO (HIRARC) DI KALANGAN PELAJAR KEJURUTERAAN UNIVERSITI PUTRA MALAYSIA

Instructions/Arahan

This questionnaire contains 2 sections:

Borang kaji selidik ini mengandungi 2 bahagian:

1. Section A: Socio-demographic background
Bahagian A: Latar belakang sosio-demografik
2. Section B: Knowledge on Hazard Identification Risk Assessment and Risk Control (HIRARC)
Bahagian B: Pengetahuan mengenai Pengenalpastian Hazard, Penilaian Risiko dan Kawalan Risiko (HIRARC)

Please be informed that you have been chosen as the study respondent. Kindly answer all questions and follow the given instructions. All data obtained from this questionnaire will only be used for study purpose. Thank you for your cooperation/ *Dimaklumkan bahawa anda telah dipilih sebagai responden di dalam kajian ini. Sila jawab semua soalan dan ikut arahan yang telah ditetapkan. Semua data yang diperolehi hanya akan digunakan bagi tujuan pembelajaran sahaja. Terima kasih atas kerjasama anda.*

SECTION A: SOCIO-DEMOGRAPHIC BACKGROUND
BAHAGIAN A: LATARBELAKANG SOSIO-DEMOGRAFIK

INSTRUCTIONS: Please tick your answer and fill in the blanks for the questions below

ARAHAN: Sila tandakan jawapan anda dan isi jawapan di ruangan yang disediakan untuk soalan dibawah

1. Age/ Umur : _____

2. Gender/ Jantina: Male/ *Lelaki*
 Female/ *Perempuan*

3. Race/ Bangsa:

Malay/ *Melayu* Indian/ *India*
 Chinese/ *Cina* Others/ *Lain-lain*

4. CGPA / PNGK

<3.000 3.000-3.500 3.501-3.750 3.751-4.00

5. What type of secondary school had you been into? / Apakah jenis Sekolah menengah yang telah anda masuki?

- National Secondary School / *Sekolah Menengah Kebangsaan*
- Secondary School / *Sekolah Menengah*
- Arts or Sports Secondary School / *Sekolah Seni atau Sukan*
- Technical or Vocational secondary school / *Sekolah Teknik atau Vokasional*
- National Religious Secondary School / *Sekolah Menengah Kebangsaan Agama*
- Fully Residential School / *Sekolah Berasrama Penuh*
- Others, please specified / *Lain-lain, sila nyatakan*
-

6. Bachelor Programme/ Program Bachelor

- Aerospace Engineering/ *Kejuruteraan Aeroangkasa*
- Civil Engineering/ *Kejuruteraan Awam*
- Agricultural and Biosystems Engineering/ *Kejuruteraan Pertanian dan Biosistem*
- Electrical and Electronic Engineering/ *Kejuruteraan Elektrik dan Elektronik*
- Chemical Engineering/ *Kejuruteraan Kimia*
- Mechanical Engineering/ *Kejuruteraan Mekanikal*
- Process and Food Engineering/ *Kejuruteraan Proses dan Makanan*
- Computer and Communication Systems Engineering/ *Kejuruteraan Sistem Komputer dan Komunikasi*

7. Industrial training sector (please specify company name) / *Sektor latihan industry (Sila nyatakan nama syarikat)*

- Manufacturing / *Pembuatan* _____
- Construction / *Pembinaan* _____
- Agriculture / *Pertanian* _____
- Others / *Lain-lain* (_____),

8. Have you attend any training related to Occupational Safety and Health? / *Pernahkah anda menyertai apa-apa latihan berkenaan dengan Keselamatan dan Kesihatan Pekerja?*

- Yes / *Ya* No / *Tidak*

If yes, please specified the training / *Jika ya, sila nyatakan latihan yang disertai:*

9. What sector do you wish to work in the future? / Sektor apakah yang akan anda ceburi di alam pekerjaan kelak?

Manufacturing / Pembuatan

Construction / Pembinaan

Agriculture / Pertanian

Others, please specify the sector / Lain-lain, sila nyatakan

10. How do you rate your OSH knowledge? / Apakah kadar pengetahuan anda tentang OSH?

Very low / Sangat rendah

Low / Rendah

Not sure / Tidak Pasti

Good / Baik

Very Good / Sangat baik

**SECTION B: KNOWLEDGE ON
HAZARD IDENTIFICATION RISK ASSESSMENT AND RISK CONTROL (HIRARC)
BAHAGIAN B: PENGETAHUAN MENGENAI
PENGENALPASTIAN HAZARD, PENILAIAN RISIKO DAN KAWALAN RISIKO (HIRARC)**

INSTRUCTIONS: Please tick your answer based on the questions below

ARAHAN: Sila tandakan jawapan anda untuk soalan dibawah

No.	Questions/ Soalan	True/ Betul	False/ Salah	Don't know/ Tidak tahu
1.	HIRARC is important in order to ensure that risks at workplace are adequately controlled at all times. / HIRARC adalah penting untuk memastikan bahawa risiko di tempat kerja terkawal sebaiknya sepanjang masa.			
2.	The machine design have nothing to do with accident that happen in workplace. / Reka bentuk mesin tidak ada kaitan dengan kemalangan yang berlaku di tempat kerja.			
3.	Heinrich theory conclude that for every 1 accident that cause a major injury there are 27 accident that cause minor injury. / Teori Heinrich menyimpulkan bahawa untuk setiap 1 kemalangan yang menyebabkan kecederaan berat terdapat 27 kemalangan yang menyebabkan kecederaan ringan.			
4.	HIRARC can only be done by the Safety and Health Officer in a company. / HIRARC hanya boleh dilakukan oleh Pegawai Keselamatan dan Kesihatan di sesebuah syarikat.			
5.	HIRARC provide a systematic and objective approach to assess hazard. / HIRARC menyediakan pendekatan yang sistematik dan berobjektif untuk menilai bahaya di sesuatu tempat.			

6.	It is not necessary to keep record on hazard that have been identified. / <i>Rekod mengenai bahaya yang telah dikenal pasti tidak semestinya perlu disimpan.</i>			
7.	A new machine that already have guard installed does not need HIRARC to be done. / <i>Mesin baru yang sudah dipasang dengan penghadang tidak memerlukan HIRARC untuk dilakukan.</i>			
8.	Doing maintenance to machine breakdown is consider as routine work. / <i>Membaiki mesin yang rosak dianggap sebagai kerja rutin.</i>			
9.	Hazard is the process of evaluating the risks to safety and health arising from hazards at work. / <i>Bahaya adalah proses menilai risiko keselamatan dan kesihatan yang timbul di tempat kerja.</i>			
10.	Using first aid record is one of the techniques to identify hazards. / <i>Rekod pertolongan cemas adalah salah satu cara digunakan sebagai Teknik untuk mengenal pasti bahaya.</i>			
11.	A near miss that occur in the workplace need to be reported to the employer or line leader. / <i>Kemalangan yang hampir berlaku di tempat kerja perlu dilaporkan kepada majikan atau ketua seksyen.</i>			
12.	Hazards are divided into five main groups which is health hazards, biological hazards, physical hazards, chemical hazards and ergonomic hazards. / <i>Bahaya boleh dibahagikan kepada lima kumpulan utama iaitu bahaya kesihatan, bahaya biologi, bahaya fizikal, bahaya kimia dan bahaya alam sekitar.</i>			
13.	Bullying is classified under the physical hazard. / <i>Buli dikelaskan di bawah bahaya fizikal.</i>			
14.	Risk is a combination of likelihood and severity. / <i>Risiko adalah gabungan kemungkinan dan keterukan.</i>			

15.	Implement short-term measures to protect workers until permanent controls can be put in place. / <i>Mempraktikkan langkah jangka masa pendek untuk melindungi pekerja sehingga kawalan tetap dapat dilakukan.</i>			
16.	Control measured for low risk may not be necessary to be done. / <i>Kawalan bagi risiko yang rendah mungkin tidak perlu untuk dilakukan.</i>			
17.	Safety device must be installed when hazard cannot be eliminated or reduce completely. / <i>Alat pelindung hendaklah dipasang apabila bahaya tidak dapat dihapuskan atau dikurangkan secara keseluruhan.</i>			
18.	Elimination is the most practicable control to be used by the employer. / <i>Penghapusan adalah cara kawalan yang paling mudah dipraktikkan oleh pekerja.</i>			
19.	Putting a barrier to protect workers from hazards is one of the administrative controls. / <i>Meletak penghadang untuk melindungi pekerja adalah salah satu kawalan pentadbiran.</i>			
20.	Medium risk requires immediate action to be done to control the hazard. / <i>Risiko sederhana memerlukan tindakan segera untuk mengawal bahaya tersebut.</i>			

THANK YOU FOR YOUR RESPONSE
TERIMA KASIH ATAS KERJASAMA