Original Article

The Effects of Training Intervention on Knowledge Level of Occupational Risk Assessment Among Engineering Students in a Public University in Selangor

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ABSTRACT: *Knowledge on occupational safety is crucial in the engineering field. In addition to reducing workplace risks, a solid understanding on the basics of occupational safety and how it corresponds to health in the specific direction of Occupational Safety and Health (OSH) will develop engineers with improved ability to ensure safety and health performance. The current engineering curriculum requires OSH-specific training to be incorporated to the body of knowledge. This study aims to assess the effects of OSH risk assessment training on knowledge level among final year engineering students in a local university in Malaysia. Method: This was a one-group pre- and post-test quasi experimental design conducted among 70 civil, agricultural, and mechanical engineering students in a public university in Malaysia. An OSH risk assessment training module based on Hazard Identification, Risk Assessment and Risk Control (HIRARC) guideline was developed and validated as the intervention tool. A 20-item questionnaire was employed as the assessment tool disseminated at pre- and post-test stages to evaluate knowledge level. The intervention was delivered in classroom settings and participants answered a self-administered questionnaire at the training's pre- and post-delivery. Data collected was entered into the statistical program and was analysed according to the study's objectives. Results: Majority were males (54%), less than 23 years old (29%), and had a cumulative grade of 3.0-3.5 (67%). The average (median ± interquartile range) knowledge scores at pre- and post-test stages were 10 (9-11) to 14 (13-15). There was a significant (p<0.05) increase in knowledge level at the post-test stage. Implications: The HIRARC training module has a potential to increase knowledge on risk assessment among engineering students. Knowledge on risk assessment will enable engineers to eliminate hazards in the conceptual or design phase of engineering work, thereby reducing the probability of accidents and ill-health from occurring in workplace.*

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

1.0 INTRODUCTION

The field of engineering combines various fundamentals, such as mathematics, science and technology, and comprises major branches of disciplines, such as chemical, mechanical, civil, aviation, and aerospace. Engineering students are taught a significant amount of fundamental knowledge related to the chosen field of study, in addition to safety aspects within a system. However, previous studies highlight the need for greater knowledge of occupational safety to help reduce accidents at the workplace (Brace et al., 2009; Endroyo et al., 2015; Noakes et al., 2011). Engineering remains one of the most important educational backgrounds of professionals in the Occupational Safety and Health (OSH) discipline (Giagloglou et al., 2014). Knowledge on occupational safety is crucial for the various teams involved in the design stage of engineering work because they have the opportunity to eliminate hazards and reduce risks compared to other professions (Behm et al., 2014). To prevent and control occupational injuries, illnesses, and fatalities, control measures designed to minimise risk must be implemented at the earliest stage (Behm et al., 2014; Goh & Chua, 2016). For example, scholars have acknowledged "Prevention through Design" (PtD) in construction as one of the proactive efforts to reduce hazards and risks throughout the design phase with the overarching aim to balance occupational safety and health over the project lifecycle (Marinelli et al., 2023). PtD is also a concept indicated in the Malaysian Guidelines for OSH in the Construction Industry (Management) (Mohd et al., 2020) adopted from the UK. The lack of safety measures implemented during the design process was attributed to the designer's mindset, lack of knowledge of work tasks, and lack of understanding of safe practices at work (Gambatese et al., 2005). A solid understanding of the basics of occupational safety and how they correspond to the health of the end user in OSH will help engineers have an improved ability to design machines that can be built with better safety measures.

In higher education institutes, OSH-related courses have been incorporated into engineering schools' curriculum (Giagloglou et al., 2014). Majority of OSH-related academic courses in Europe have been organised by engineering schools (Arezes & Swuste, 2013), and the need for OSH courses in engineering classrooms during formal education has been reported since 1999 (Bryon Jr, 1999). Regarding engineering courses in tertiary education in Malaysia, the Malaysian Qualification Agency (MQA) has set the benchmark for engineering and engineering technology standards in its guideline released in 2011 (Malaysian Qualifications Agency, 2011). Its program outcomes adapted from the Sydney Accord revolves around design solutions for engineering technology systems (Malaysian Qualifications Agency, 2011) to meet specific needs for health and safety responsibilities, considering public health (Malaysian Qualifications Agency, 2011). Hence, knowledge on OSH has been or must be incorporated into the curriculum.

The OSH risk assessment training module delivered was intended to provide basic information on risk assessment and to provide knowledge. The training was delivered using simple words that can make the students easily understand the content of the training module. The use of multi-media pictures, videos, figures and within context-examples was incorporated to help students understand the information in the training module. One study in Spain reported to improve safety knowledge and commitment among students, safety program utilising expositive and demonstrative teaching methods were more suitable compared with other teaching methods (Rodrigues et al., 2018).

Literature reported studies of OSH risk assessment training among undergraduates, but these are limited and some examples are as follows: Ramzi and Abdulwahid (2020) and Endroyo et al. (2015). Ramzi and Abdulwahid (2020) reported the effects of training on basic principles of health and safety among undergraduates including engineering students and reported significant increases in knowledge and improvement in attitudes. Endroyo et al. (2015) reported the need for industry-based OSH learning model which consist of contextual learning, cooperative learning and competency-based leaning to be used for undergraduates training. Training in OSH during educational years of engineering students is imperative because they are mostly young people who will enter the working sectors upon graduation. Training on safety must be done continuously as safety cover a very wide aspect in order to improve skills and performance of engineering students (Sorby et al., 2013) and to reduce risk of workplace accidents (Zakaria et al., 2012).

Risk assessment methodologies vary. According to ISO 31010:2019 Risk Management Techniques (Naji et al., 2019), there are more than 30 methods for risk assessment. The most commonly-used method in the Malaysian industrial setting is Hazard Identification Risk Assessment and Risk Control (HIRARC) (Department of Occupational Safety and Health, 2008). HIRARC is a tool used to identify hazards and assess associated OSH risks, and provide specific suggestions to control the risk. Risk assessment is a semi-quantitative tool and is key in reducing incidents and preventing near-miss in the workplace. Researchers have emphasised the need for OSH-related training including risk analysis for engineers and education for engineering students to be developed in college, schools, and professional associations, providing valuable tools to improve safety performance (Amaya-Gómez et al., 2023; Endroyo et al., 2015). With the many possible catastrophic scenarios that the world is experiencing, engineers need to be more prepared for risk assessment and management (Kerin, 2016).

Studies relating to OSH awareness or knowledge among vocational and engineering students have been reported globally (Gultom et al., 2022; Jaafar et al., 2021; Khalid et al., 2022; Mohamed et al., 2021; Ramli et al., 2020; Rauzana & Dharma, 2021). However, few studies have examined the effects of training on OSH risk assessment among engineering students (Endroyo et al., 2015; Rauzana & Dharma, 2021). The effects of training on OSH risk assessment among engineering students have yet to be reported in Malaysia. Awareness of risk assessment fundamentals must be encouraged because the law requires safety to be the responsibility of every person in an organisation, and is not restricted to a job for a person involved with safety and health, such as the employer, safety officer, or the safety and health committee (Occupational Safety and Health 1994 (Act 514), 1994). Therefore, this study aimed to assess the effects of OSH risk assessment training on the knowledge level of final-year engineering students at a local university in Malaysia. This study provides basic information which can be used by the higher education sector to evaluate and re-assess current engineering students' curriculum. Consequently, continuous development to strengthen the curriculum to improve the education system can be performed to prepare graduates for working in industries.

2.0 MATERIALS AND METHODOLOGY

2.1 Study Design and Study Location

This study uses a group pre- and post-test quasi experimental design, conducted in an engineering faculty at a public university in Central Malaysia. The university was chosen as the study location because it is one of five research universities in Malaysia and is centrally located in the Klang Valley. The engineering participants in this public university were ranked among the best 100 in the QS World University Ranking in 2018. This study was conducted between September 2018 and April 2019.
A training module was developed as an intervention tool, and a related questionnaire was developed from the training module to be used as an assessment tool. The scores obtained from the completed assessment tool were used to compare the knowledge levels of risk assessment.

2.2 Study Population and Sampling Method

The target population for this study was the 4th or final year undergraduate engineering students from the selected university. The sampling frame was a list of Malaysian students in their 4th year in engineering at the university, regardless of gender. Only final-year students were selected as the target population in this study to ensure that they had already studied most of the engineering subjects and had attended and completed their industrial training for 10 weeks. Convenience sampling was also performed.

2.3 Study Instruments

The intervention tool consists of a module presented to the participants in the form of slide presentations. The researchers developed the intervention tool and questionnaire used to assess the effects of the training module; all information were adapted from the guidelines of the Department of Occupational Safety and Health (DOSH) on risk assessment widely used in Malaysia, which is the HIRARC method (Department of Occupational Safety and Health, 2008).

2.3.1 Training Module

Training was conducted by one researcher and took place immediately after the participants answered the pre-intervention questionnaire. Each session was completed within one hour. To evaluate the increase in knowledge, the same questions were used for the pre- and post-intervention. Fig. 1 shows an excerpt of the training slides developed and used as the intervention.

To effectively deliver the module, the researcher attended courses related to presentation skills such as Academic Interaction and Presentation, and Communication and Professional Development. The researcher was trained to deliver the module to the research team before training the participants. Presentations were given in small groups of five on different days based on participants' availability between classes. The lecture method was used following Sajjad (2010).

The training consisted 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)

2.3.2 Questionnaire

Questionnaires were used as the main study instrument to assess the effects of the given intervention. The questionnaire was provided in English and consisted of two sections.

Section A: Socio-Demographic

In this section, several questions on gender, age, ethnicity, engineering courses, industrial training sectors, and past training involvement in OSH were asked.

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

This section consists of items on HIRARC, and a survey was conducted to examine participants' knowledge regarding HIRARC. This study focused only on assessing the level of Knowledge as the main element, because the elements of Attitude and Practice were not practicable to engineering students, as they only apply the information when they are working at a later stage. We compared participants' current knowledge and changes in their knowledge level after training on HIRARC has been implemented.

The pre-intervention questionnaire, which consisted of sections A and B, was given in hard copy. For post-intervention, only section B was administered to the participants through an online quiz using an application called Kahoot! to incorporate gaming elements into the intervention process. At the end of the online quiz, the application summarised the participants' results and projected them onto the device of the administrator, while scores were provided in the form of Excel sheets that were downloaded for analysis.

Section B consists of 20 items, to be answered by True, False, or Don't Know. Positive and negative questions were asked. One score was given for each correct answer while zero was given for each wrong and Don't Know answer. The scores were summed and categorised into three levels: high (71%-100%) or scores from 14 to 20, medium (51%-70%) or 10 to 13, and low (less than 50%) or 0 to 9 (Anees et al., 2014).

2.4 Study Instruments

The questionnaire and training module were validated and reviewed by three experts, including two academics with postgraduate training in OSH and one with an engineering background. This is to ensure that the questions are valid and relatable with the study objectives and the discipline of OSH and the engineering field.

Pretesting, which included the administration of the questionnaire and training module, was conducted among a group of engineering students (10% of the study sample size) from the same engineering faculty. The researcher who delivered the training module is well-versed in HIRARC and had already been trained to practice it in an actual workplace environment.

The internal consistency of the items on HIRARC knowledge was tested using Cronbach's alpha analysis, and the value obtained was 0.629. Based on the study by Ahdika (2017), Cronbach's alpha score between 0.6 to 0.8 was considered reliable. In the pre-test, the participants were asked to point out any ambiguous terms in the questionnaire and training module. These questions were corrected before they were administered to the study participants. The results of the pre-test were not included in this study.

2.5 Ethical Considerations

This study was approved by the Institutional Review Board (reference number UPM/TNCPI/RMC/1.4.18.2). Written consent was obtained from all participants prior to the study. All information obtained from participants was used only for this study's purposes.

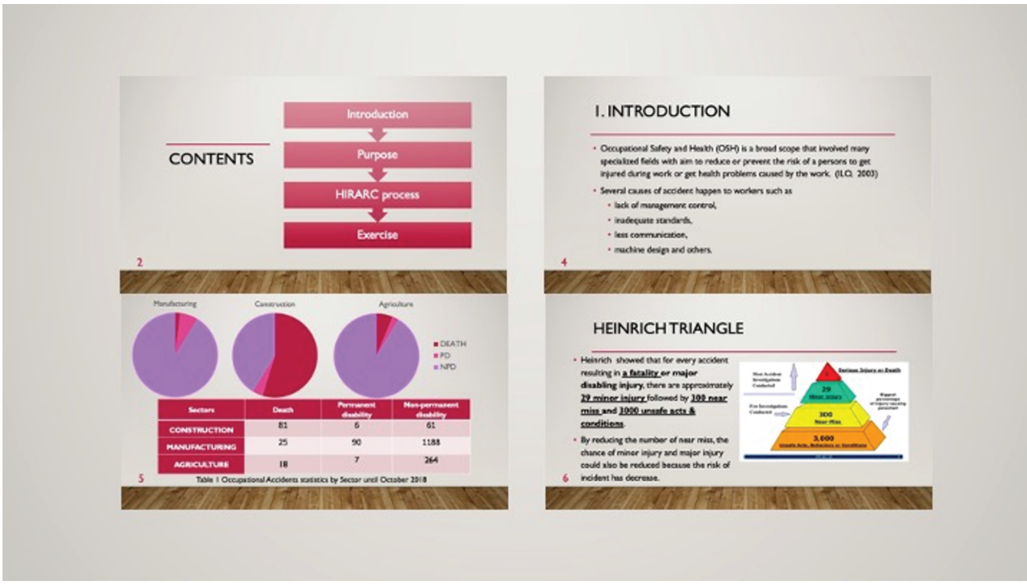

Figure 1: Example of HIRARC slides developed and used for intervention

3.0 RESULTS

3.1 Socio-demographic Distribution

This study involved 70 respondents, comprising 38 (54.3%) males from three different courses: 28.6% (n=20) from Civil Engineering, 38.6% (n=27) from Agricultural and Biosystem Engineering, and 32.9% (n=23) from Mechanical Engineering. Most were under 23 years old (62.8%; n=44), and 85.7% (n=60) were Malay. In terms of academic grades (Cumulative Grade Point Average, CGPA), most (n=47; 67.1%) scored between 3.00 to 3.50. Table 1 describes the sociodemographic backgrounds of the engineering students who participated in this study (n=70).

Table 1 Socio-demographic Background of Engineering Students in a Public University (n=70)

Variables	Items	N=70	
		Frequency (%)	Mean (SD)
Gender	Male	38 (54.3)	
	Female	32 (45.7)	
Age	<23	44 (62.8)	23.76 (1.31)
	24-25	17 (24.3)	
	>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)	

Table 1 Socio-demographic Background of Engineering Students in a Public University (n=70) (continued)

Variables	Items	N=70	
		Frequency (%)	Mean (SD)
School	National Secondary School	41 (58.6)	
	Secondary School	3 (4.3)	
	Technical or Vocational Secondary School	8 (11.4)	
	National Religious Secondary School	2 (2.9)	
	Fully Residential School	16 (22.8)	

SD: Standard Deviation

In terms of industrial training, 14 (20.3%) students underwent industrial training in the manufacturing sector, 22 (31.9%) in the construction sector, 18 (26.1%) in the agriculture sector, and 16 (21.7%) in other sectors, such as oil and gas, consultancy, aquaculture, and power plant stations. Half of the students had attended training related to OSH. Some of the training was provided by authority bodies such as the Construction Industry Development Board (CIDB) Malaysia, while others were provided in-house by experts from the chemical manufacturing and oil refinery industries. Other related training include cardiopulmonary resuscitation (CPR) training, Occupational Safety and Health seminars, and confined space-related training such as inert entry training and blue card training. The remaining 50% (n=35) have not attended any OSH-related training.

When asked about which sectors they wish to work for in the future, 26.1% (n=18) of them wish to work in the manufacturing sector, 30.4% (n=20) in the construction sector, 26.1% (n=17) in the agriculture sector, and 17.4% (n=15) in other sectors such as aviation, oil and gas, consultancy and oleochemical sectors. Lastly, when asked to rate their perception of their knowledge level related to OSH, approximately 63% (n=44) of the participants perceived themselves as having a good knowledge level. Table 2 presents the distribution of OSH exposure reported by participants.

Table 2 Exposure to OSH Reported by Engineering Students in a Public University (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
Sectors to work for 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

Table 3 Frequency Distribution of Correct and Wrong Answers of Knowledge on HIRARC Scored at The Pre- and Post-test Stage (n=70)

No.	Questions	Pre-intervention		Post- intervention	
		Frequency (%)			
		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 1 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)

3.2 Overview of Knowledge Scores and Level on HIRARC at Pre- and Post-Intervention Stages

In general, almost all items in the questionnaire showed a higher shift in the frequency of correct answers at the post-intervention stage. Table 3 presents the frequency distributions of correct and incorrect answers scored by the participants at the pre- and post-intervention stages.

The average mean (standard deviation [SD]) scores for the pre- and post-tests were 10.00 (1.69) and 13.91 (1.76), respectively. When the knowledge scores were analysed, there was a significant increase in knowledge scores between the pre- and post-test stages. Table 4 shows the median scores for knowledge of HIRARC and the statistical test values at the pre- and post-test stages.

Table 4 The Distribution of Average Knowledge on HIRARC Scores Among Engineering Students in a Public University at Pre- and Post-test Stage (n=70)

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

Statistical test: Wilcoxon signed-rank test **p-value significant at 0.05 level*

The raw scores were categorised into three groups: high, medium, and low. The data obtained in this study clearly indicate an increase in knowledge levels after the training was delivered to engineering students. For the pre-test, 70% (n=49) of the respondents were categorised into the medium knowledge group. However, after the interventions, 45 (64.3%) of the respondents were categorised into the high knowledge group, and no respondents were categorised into the low knowledge category. Table 5 presents the distribution of knowledge of the HIRARC categories at the pre- and post-intervention stages among the respondents.

Table 5 Knowledge Level on HIRARC for The Pre- and Post-test Among Engineering Students in a Public University (n=70)

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

4.0 DISCUSSION

OSH is a wide field that comprises various scopes such as risk assessments, emergency preparedness and response, incident investigations, operational control and others. For local undergraduate engineering curriculum, qualification body have provided the clear guide that OSH knowledge is a required body of knowledge (Malaysian Qualifications Agency, 2011). HIRARC is a simple risk assessment tool and one of the most basic safety tools to help protect workers from risks of hazards at work. This study determined the effects of training on respondents' knowledge level among 70 respondents from three different engineering courses in a public university. This study reported a significant increase in knowledge level on risk assessment when the pre-test is compared with the post-test scores.

The level of knowledge on OSH risk assessment in this study was generally moderate before the module delivery. As compared to other studies assessing OSH-related knowledge, one study on ergonomics among 247 engineering students in Malaysia found that knowledge level was moderate (mean=2.74; SD=1.21) (Jaafar et al., 2021). In the present study, the students reported that they have learned about the concept of Hazard and Operability Study (HAZOP) which is a more complicated tool than HIRARC. HAZOP is a tool that identifies hazard and danger that might occur during the machine processing. Hanum et al. (Hanum et al., 2023) performed a comparison between HIRARC and HAZOP methods and has identified that HIRARC is more dominant to the human factor while HAZOP focuses more on the equipment factor. It is suggested that there may be benefit if inclusion of OSH risk assessment is more thorough in the existing curriculum. Arisoy and Stojcevski (2009) reported on how one university in Australia introduced Occupational Health and Safety and Risk Management practices from the onset of their engineering students' studies and continually reinforced OSH as a priority throughout the learning years.

In terms of OSH knowledge, some aspects could only be appreciated when students have gained industrial experience, in addition to traditional university method that could not address complex interactions in safety (Pitt, 2012). In this study, half of the respondents had already attended 10 weeks' worth of industrial placement in many different types of industries. Most of the respondents had to go for compulsory training before entering their industrial training hence this can serve as a crucial phase where OSH training could be incorporated. About 50% (n=35) of the respondents have attended training related to safety in construction industry by the Construction Industry Development Board (CIDB) which focus on facilitating the construction industry, Cardiopulmonary Resuscitation (CPR) training, Occupational Safety and Health seminar, blue card training for improving safety performance in the transportation industry and lastly, inert entry training that trains people on safety before going into inert space.

Overview from several guidebooks for bachelor's in engineering degrees in Malaysia, it was found that OSH was not a core subject being offered. Instead, it is embedded as part of an existing subject in the curriculum. In the present study, the university's undergraduate study programme handbook indicated two core courses on OSH which was Safety and Risk Assessment and OSH in Processing Industries. Based on the course structure of engineering students from two public and one private universities in Malaysia, it was found that safety, hazard and risk assessment is not a specific subject being taught instead because safety is intertwined as a sub-topic in certain subjects allotted in the engineering courses. This is in line with the practices elsewhere. Institute of Occupational Safety and Health (IOSH) for example, a chartered body for safety and health professionals has identified the need to reassess the element of OSH in undergraduate engineering courses in the UK. As a results, modules which incorporates OSH elements were developed which materials in some sections being focused on specific engineering discipline and environment related to the learning needs of undergraduate engineers. This can overcome challenges which includes high existing demands and pressures on undergraduate time and lack of practical, active learning methods for OSH in a learning environment dominated by theoretical learning methods (Debruyne et al., 2010). Alternatively, it has been suggested that training on OSH could be incorporated under the Life-Long Learning framework in universities and should be offered in a scheme of five thematic areas namely OSH management system, risk assessment, OSH in high-risk sectors, human-centred OSH in high-risk sectors and OSH through advanced technology (Giagloglou et al., 2014).

5.0 CONCLUSION

Overall, this study found that training was linked to increased OSH risk assessment knowledge. This module may be further refined and adapted in other educational institutions to provide an understanding and increase awareness of the importance of HIRARC, which could be beneficial for engineering students before joining the work environment. The findings from this study suggest the potential for the incorporation of HIRARC elements as sub-topics in engineering curricula to equip engineers with the ability to eliminate hazards in the conceptual and designing phases of engineering work, thus reducing the probability of accidents and ill-health occurring in the workplace. We hope that the materials developed in this study will help prepare students for an immersive safety culture mindset. . Limitations of this study includes that there were no control or comparison group included as such there is no way to determine that the training provided was better than a standard course or topic in a subject. Besides short-term testing, which may not show how well students remember or use the knowledge later on. The results might also be different for students from other universities or programs

It is suggested that future study to be conducted with the inclusion of a control group to assess the risk assessment module and compare it with a standard course or topic on OSH risk assessment provided in curriculum. Adding hands-on activities like simulations could make learning more practical.

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