Enhancing the Construction Site Safety Knowledge and Awareness Amongst Civil Engineering Undergraduate Students

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Abstract: There are numerous hazards that could harm the workers and cause accidents in the construction industry. Therefore, undergraduate students need to be exposed to and educated about the construction site safety. A study in exploring the knowledge and awareness of construction site safety among students of civil engineering is significant as this group of students are the prospective industry's personnel in the future. This study is conducted to: (1) determine students' knowledge of construction site safety management, (2) investigate the level of students' awareness toward site safety practices; and (3) indicate students' understanding of construction site accident implication. Respondents are required to answer a questionnaire survey non-verbally to indicate their knowledge and awareness of the construction site safety. Statistical analysis is used to analyse the collected data. From the findings, there are no differences on the level of knowledge and awareness between female and male students towards the site safety aspects. Both groups of students have a high level of knowledge on the site safety management and site accident implication. Students are also aware of the elements of safety practices implemented at the construction site. However, a few aspects need to be enhanced in the learning and teaching process. Indirectly, the findings provide supplementary information to examine the construction safety education which needs to be embedded in the programme curriculum and system. It will be beneficial in improving the humanity aspects among students as these students will be exposed to the most hazardous workplace in the future.

Keywords: Accident, Awareness, Construction, Safety Management, Safety Practices

1. Introduction

In the Malaysian construction industry, approximately 25-30% of the reported accidents caused fatalities, and yet these accidents could be prevented if all the safety measures had been strictly implemented at the construction sites. Therefore, construction safety education plays an essential role in ensuring the safety and health of a construction site (Pedro et al., 2018). It should be introduced to

anyone in the cluster of Architectural, Engineering, And Construction (AEC) industry such as clients, architects, engineers, contractors, workers, suppliers and students. Numerous efforts such as safety training programs (Loosemore, 2019) have been conducted to improve the overall safety and health of construction sites. However, most of the previous research focused on the safety education among construction workers (Yan et al., 2022), due to the lower education level compared to other groups. The deficiencies in implementation of safety practice on sites still exist in view of the lack of monitoring works. Therefore, this research is mainly focused on the group of future site supervisors or assistant site engineers who will oversee the supervision task in construction projects. Thus, the samples of this research are the current students of Diploma in Civil Engineering who will probably be involved full time in monitoring the execution of construction works in the future. The aim of this study is to investigate the knowledge and awareness of this group of students towards construction site safety, while enhancing site safety understanding and fostering site safety awareness before entering real world working situations. Three main perspectives are evaluated and discussed; (1) Construction site safety management, (2) Construction site safety practices, and (3) Construction site accident implication. In addition, the differences of understanding and awareness between male and female's student were also explored. The discovery of this study may provide insight to the faculty as to improve the approach of delivery during the teaching and learning process. According to Ariffin et al. (2022), universities can improve the components of the educational system that can help students develop their motivation, behaviour, and achievement by taking into account students' understanding, expectations, perceptions, and evaluation of their university education and its impact on their personal development.

2.1 Construction Site Safety Management

According to the Department of Occupational Safety and Health (DOSH) (2017), all construction sites are expected to provide a safe and conducive working environment for all workers as required by Occupational Safety and Health Act (OSHA) 1994. This includes the elimination of hazards on the construction site during the planning and design phase as the hazard removal becomes more complex as the project progresses (Finneran & Gibb, 2013). Meanwhile, it is compulsory for all construction workers to attend a safety and health safety induction course before entering the construction site (CIDB, 2019). Other than that, the managerial supervision or work inspection must be conducted by a competent designated person as required by Building Operations and Works of Engineering Construction (Safety) Regulations, 1986 (CIDB, 2019). Therefore, good planning and strategies are needed to ensure a safe working environment and maintenance at a construction site. In addition, a Safety and Health Officer (SHO) should be employed for a project that costs more than RM20 million and responsible to communicate for promoting and ensuring safe workplace practice is implemented at the site for the rest of the construction contract period (CIDB, 2019). Furthermore, a construction company needs to allocate a substantial amount of budget to provide their workers with the safety protective equipment, safety induction courses and safety training to increase the awareness among their workers about safety during conducting work at the construction site (Keng & Razak, 2014).

2.2 Construction Site Safety Practices

The legislation requires employers to create a safe workplace for their employees by having an Occupational Health and Safety (OHS) policy. The formal OHS policy statement shows the organization's dedication to the safety of its employees and the work's premises. Besides, knowledge is a crucial aspect to ensure the successful implementation of an OHS management system and policy in the construction industry (Törner &Pousette,2009). In addition, the expenses caused by accidents, injuries, and illnesses at the workplace can be mitigated with the help of a solid OHS strategy (Jilcha & Kitaw, 2016). A good implementation of safe working conditions is not only based on explicit knowledge alone but relies on a variety of implicit types of knowledge, including the engineer's safety experience, perceptual and cognitive abilities, rules of thumb, intuition, and the synthesis of facts and physical experiences. Therefore, continuous improvements need to be thoroughly done as it is directly correlated with higher levels of safety and better project outcomes (Alkaissy et al., 2020).

Hazard Identification, Risk Assessment, and Risk Control (HIRARC) is a foundation of OSH and must be conducted in a construction project. It involves actions including looking for potential threats, determining how serious those threats are, and coming up with solutions (Saedi et al., 2014). As a fundamental of risk management, HIRARC is now widely used in all facets of business, from strategy development to daily operations. It was realized that this is a preventative approach to risk management since it would allow the detected danger to be mitigated before it became the incident's primary causal factor (Verbano & Venturini, 2013). In addition, HIRARC and regular toolbox talks are highly successful in fostering a culture of safety and solidifying employees' grasp of the material covered in a formal training. Toolbox talks which are also known as safety talks, are an efficient way to address unsafe practices with all field workers. This preventative and frequent action of daily toolbox talks is proven to reinforce safety information and can reduce workplace accidents better compared to monthly toolbox talks (Olsen et al., 2016). Therefore, toolbox talks are considered as an excellent addition to any safety program as these talks promote workplace safety, boost team morale, reduce insurance costs, strengthen safety compliance, and reduce the likelihood of safety infractions (Katharina et al., 2017).

Besides, construction sites must have appropriate safety signage to guarantee compliance with OSHA regulations on worker safety. The purpose of these signs is to notify employees and visitors about any potential risks that may be faced at a workplace (Winge & Albrechtsen, 2018). Therefore, for everyone's protection, the law requires construction sites to provide sufficient safety signage for both employees and visitors. In addition, one of the best ways to ensure the worker's safety and prevent OSHA fines is to maintain a clean construction site (Emuze et al., 2016). The term "good housekeeping" refers to a building site that is clean and well-organized. Thus, accidents and the onset of unwelcome events are both diminished when the workplace is neat and tidy. Therefore, good housekeeping is also highlighted as an important aspect in construction safety practices.

2.3 Construction Accident Implication

Various impacts of construction accidents have been previously reported but the main implications were commonly related to cost, economic and social aspects (Kavya & Pradeep, 2019; Muhamad Zaini et al., 2020). These impacts could affect both companies and individual workers. According to Elsebaei et al. (2020), there are two types of cost implications namely direct and indirect costs. Direct cost is defined as the cost that is visible such as compensation, medical care, material and equipment damage, high legal cost, and insurance claim. The indirect costs are defined as all the non-insurable costs incurred at the time when the accidents happened. It was hard to identify yet continuously is a burden until the case was settled. When an accident occurs, all workers stop working and give their attention to the injured person, thus the working productivity will be reduced which will impact the company's working progress and activities. Besides, the cost allocated for the investigation of the accidents that were authorized by the company is also considered as indirect cost.

Furthermore, the construction accidents also affect companies and workers in terms of economic value. Some injured workers cannot continue the job because of a permanent injury. The workers will not have income and will suffer from the individual economic reduction. It is not only affecting themselves but also the economy of the families. In addition, this will relate to the psychological burden on workers and victims. The last main impacts were on social aspects that will burden companies and victims. Shin and Kim (2015), has studied the brand image impacts of the company after an accident occurred. The findings revealed that 43% of respondents from consumers hardly use the product of the company that has safety issues related to their workers. Therefore, it was clearly seen that the reputation of the company will drop if they are having safety issues that lead to accidents.

3. Methodology

In this study, an online survey is adopted to determine the knowledge and awareness of construction site safety perceived by students in a public higher institution which is located at Pasir Gudang, Malaysia. A questionnaire is designed using Likert scale and has been validated by an expert.

A pilot test also has been conducted before the questionnaire is distributed to the respondent. Fig. 1 shows the research methodology framework presented in this paper.

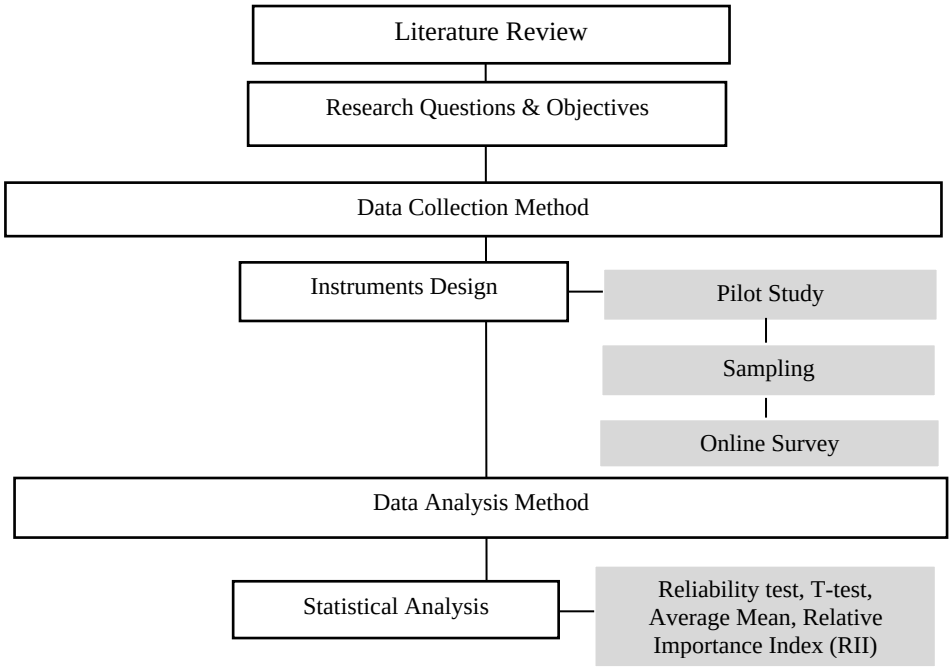

Fig. 1 Research methodology framework

3.1 Data Collection Method

3.1.1 Questionnaire Design

A questionnaire set was designed on a web-based survey application as the instrument to collect data directly from the respondents. The questionnaire consists of 41 questions in the English language. These questions are divided into four sections. Section A is aimed to collect the demographic information of the respondents. Section B is dedicated to collect data regarding the respondent's knowledge on the implementation of safety management in the construction industry. Section C is designed to determine the awareness of the site safety practices which have been implemented at the work site. The last part is Section D which identifies the knowledge of respondents on the implication if accidents occurred at site. The items formulated in this study are being addressed by doing content analysis of literature review. The five-point Likert Scale ranging from 1 representing strongly disagree to 5 representing strongly agree is used to measure each variable in Section B and D. Meanwhile, the rating for five-point Likert Scale in Section C is labelled as strongly not aware for range 1 to strongly aware for range 5 in measuring each variable.

3.1.2 Validity and Reliability of Instrument

The content of the developed questionnaire was validated by a panel of expertise who is an Associate Professor from School of Civil Engineering, College of Engineering, Universiti Teknologi MARA Shah Alam, Malaysia. The comments and input on the constructed adopted items are given as to assess the questionnaire readability and validity. Modifications and refinements of words and structure were made as per comments received to enable better understanding and to organize the sequence of questions. This is done prior to the pilot test done among thirty students randomly selected for clarity, significance, and acceptability. The Cronbach's alpha coefficient is obtained for each section to determine the reliability of the instrument.

3.1.3 Sampling

In this study, students who are currently in the second year of the Diploma of Civil Engineering Programme, Faculty of Civil Engineering, were selected as the targeted population. Table 1 shows that the total population is 119, comprised of 71 male students and 48 female students. According to Krejcie Morgan (1970), the minimum number of samples to represent this population is 92 students, thus satisfied the Morgan sampling technique.

Table 1. Number of population and sampling

Semester	Year	Part	Gender	No. of Student
March - August 2022	2	4	Male	71
			Female	48
			Total	119

3.1.4 Questionnaire Survey

The questionnaire surveys were administered online. It was conducted via Google Form to obtain responses from the respondents. The final survey link was distributed among the students via various social media platforms such as WhatsApp and Telegram group. The survey was conducted in the period of 2 months which is from the end of April 2022 to the end of June 2022. After the respondents have completed the questionnaire, the responses were submitted, and the responses were recorded on the online database application.

3.2 Data Analysis Method

After the response is closed, the data were downloaded from the Google Drive database for analysis. All collected data were entered into Microsoft Excel 2010 and cross checked for presence of any error and redundancy to maintain its accuracy. Then, the data were entered into the data analysis program, Statistical Package for the Social Sciences (SPSS) version 22. This tool is used to organize and analyse all the available data that were gathered from the questionnaires. The value of skewness should fall between -2 and +2 to be accepted (George & Maleery, 2010). In this case, the value is valid and within the range which is -0.205 for data of Site Safety Management, -0.439 for data of Site Safety Practices and -0.663 for data of Site Accident Implication. Therefore, the data collected in this study is considered as normal.

4. Results and Discussion

4.1 Cronbach's Reliability Test

Table 2 indicates the reliability coefficient of all variables used in this study. According to Sekaran and Bougie (2017), Cronbach's alpha coefficient values lower than 0.6 is considered poor, whereas 0.70 is deemed to be good, more than 0.8 is very good and the value 0.9 and above is considered as excellent standard of the instruments. After the pilot testing, the results of the reliability test show the Cronbach's alpha value for the respective examined construct is ranging from 0.71 to 0.94. This indicates that all variables have a high reliability value which is above 0.70. It can be concluded that the internal reliability of the questionnaires is acceptable and satisfactory. Therefore, there is no need to remove any item from design instruments.

Table 2. Reliability testing

Construct Variables	No. of elements	Cronbach's Alpha Coefficient	Strength of Association
Site Safety Management	9	0.705	Good
Site Safety Practices	9	0.907	Excellent
Site Accident Implication	9	0.938	Excellent
Total	27	0.936	Excellent

4.2 Respondents Demographics

Out of 119 participants, 98 respondents have given their consent of voluntary participation and completed the questionnaire with a response rate of 82.35%. From the total respondents, 57 were male students and 41 were female students. During the teaching and learning (TnL) process, it is reported that most of the students (59.2%) were exposed to and gained information and knowledge related to construction safety from the lecturer's briefing before starting the class regardless of lecture, tutorial or laboratory session. Besides, 39.8% of the students agreed that they gained the knowledge of construction safety from the lecturer's briefing early in every semester. Meanwhile, only 1% of students gained the knowledge by reading the course's lesson plan handout. According to Baba and Affendi (2020), most of the students spend some time reading academically and leisurely daily for educational purposes and pleasure. In addition, more than half of the students (66.3%) agreed that the laboratory-based course exposed themselves to the knowledge of safety and health during the learning and teaching process. Besides, the theoretical-based course shows the second highest course that exposed the students to the knowledge on construction site safety and health knowledge (31.6%) and only 2% agreed that they were exposed and gained knowledge from the calculation-based courses. Based on the results, 72.4% of the respondents show their agreement that by having physical on-site visit experience, this can help to increase the safety and health knowledge amongst students. This is aligned with previous study which reported that students with at least one site visit experience have better achievement and understanding on the safety issue compared to students with zero site visit experience (Ismail et al., 2021). Meanwhile, 19.4% of students chose to have the awareness campaign or programme in improving their knowledge and only 7.1% having insight that the construction safety and health knowledge can be gathered by inviting speakers from the industry to share experience among other things. There is also 1.0% of students who did not show any interest towards the approaches or methods to increase safety and health knowledge. Moreover, most of the students (89.8%) do not have any experience attending any courses or training related to construction safety and health throughout their study time. From the survey, only 10 students have attended course or training at least 1-2 times or 3 times and more, respectively. Table 3 shows the demographic information of the respondents in this study.

Table 3. The demographic information of the respondents

Demographic aspect	Items	Freq	(%)
Gender	Female	41	41.8
	Male	57	58.2
Sources of information/knowledge about construction safety in the teaching and learning processes	Briefing by lecturer early of each semester	39	39.8
	Briefing by lecturer before starting each class Lecture/Tutorial/Laboratory	58	59.2
	By reading from the course lesson plan/ handout	1	1.0
Types of civil engineering course/subject which exposed student to	Theoretical based course/subject	31	31.6
	Calculation based course/subject	2	2.0
	Laboratory based course/subject	65	66.3

Demographic aspect	Items	Freq	(%)
the knowledge of safety and health in learning and teaching process			
Approaches or methods to increase safety and health knowledge amongst students	Conduct physical on-site visit	71	72.4
	Invite speaker from the industry	7	7.1
	Awareness campaign or programme	19	19.4
	Other	1	1.0
# of attended construction safety courses or training	None	88	89.8
	1-2 times	8	8.2
	3 times and more	2	2.0

4.3 An Independent T-Test Analysis

Table 4 shows the mean score of responses given by female and male students towards the variables which have been investigated in this study. Female students have higher mean scores compared to male students for all evaluated aspects; (1) Construction site safety management (2) construction site safety practices and (3) construction site accident implication.

Table 4. T-test analysis

Variables	Gender	N	Mean	Std. Deviation	Std. Error Mean
Site Safety Management (SSM)	Female	41	4.049	0.422	0.066
	Male	57	4.012	0.503	0.067
Site Safety Practices (SSP)	Female	41	4.263	0.494	0.077
	Male	57	4.170	0.550	0.073
Site Accident Implication (SAI)	Female	41	4.054	0.578	0.090
	Male	57	4.049	0.695	0.092

A t-test is a type of statistical test that is used to compare the means of two groups. An independent t-test can be used when the two groups under comparison are independent of each other. As the t-test is a parametric test, it is adopted in this study for an intergroup comparison of female and male students. An independent sample t-test was conducted to further analyse the differences of knowledge and awareness between both gender's groups of students. In this case, the significant, p value of Levene's Test for Equality of Variances for all variables is more than 0.05 which is 0.176 for site safety management, 0.611 for site safety practices and 0.496 for site accident implication. Therefore, the variance for female and male students is assumed equal. Hence the value of p (Sig. (2-tailed)) on the top row is referred. The p (Sig. (2-tailed)) values for site safety management, site safety practices and site accident implication are more than 0.05 as shown in Table 5. Therefore, this indicates that there is no statistical significance between female and male students on the knowledge and awareness of all aspects which has been investigated in this study. There are no differences between female and male students which means both groups acquire the same level of understanding and awareness of all aspects.

Table 5. Independent samples test

Variables		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig., (p)	t	df	Sig., (p) 2-tailed	Mean Diff.	Std. Error Diff.	Lower	Upper
SSM	Equal variances assumed	1.859	0.176	0.384	96	0.701	0.037	0.097	-0.154	0.229
	Equal variances not assumed			0.396	93.705	0.693	0.037	0.0937	-0.149	0.223
SSP	Equal variances assumed	0.260	0.611	0.864	96	0.390	0.093	0.108	-0.121	0.308
	Equal variances not assumed			0.879	91.270	0.382	0.093	0.106	-0.118	0.304
SAI	Equal variances assumed	0.467	0.496	0.041	96	0.967	0.065	0.133	-0.258	0.269
	Equal variances not assumed			0.042	93.907	0.966	0.006	0.129	-0.251	0.261

4.4 Relative Importance Index Analysis

In this study, Relative Importance Index (RII) technique was adopted since the value of the index specifies the ranked degree of importance. According to Aibinu and Jagboro (2002), the Relative Importance Index (RII) approach is used to describe the relative importance of the specific causes and effects based on the likelihood of occurrence and effect on the project using the Likert scale of five scales. The RII value has calculated for the data collected based on the formula by Saleh (2015) as shown in Eq. 1. Next, Eq. 2 is being introduced into Microsoft Excel 2016 and used to calculate the RII for each set of variables. In this study, RII is used to investigate the level of students' knowledge toward the elements studied for site safety management and accident implication once accidents occurred at site and indicate the level of students' awareness on the elements of site safety practices. The higher value of the RII shows the critical cause or impact component.

$$Relative\ Importance\ Index = \frac{\sum W}{A*N} \quad (1)$$

$$Relative\ Importance\ Index = \frac{5(n5)+4(n4)+3(n3)+2(n2)+1(n1)}{5(n1+n2+n3+n4+n5)} \quad (2)$$

where W represents the weight assumed by the respondents for each question, ranging from one to five, while A indicates the maximum weight which is five in this case; and N corresponds to the number of the respondents.

4.5 Average Mean and Relative Importance Index Analysis on Site Safety Management

Site safety management includes guidance on safety, rules and documentation, safety planning, emergency readiness, as well as response plans and safety approach. It is a crucial element that must be applied in the construction sector. In this study there are nine elements of site safety management which have been selected to be explored. Students agreed that it is compulsory for all workers to attend a safety induction course before entering the construction site by indicating the highest mean value (4.45). This shows that students acknowledge the importance of acquiring safety knowledge before entering any construction site. Besides, students also believe that effective communication between workers at all levels influences safety performance at site with the mean value of 4.33. As discovered by Saeed (2017), poor and insufficient communication at a construction site may lead to accidents, especially for the construction staff with low educational level. Therefore, effective communication between workers at all levels is crucial as it influences safety performance at the site.

The mean value of 4.22 also indicates that students also had good exposure that the construction site is the most hazardous and dangerous workplace. This shows good insight as construction sites are considered a hazardous and dangerous workplace compared to other sectors which recorded a high number of injuries and fatalities (Ajith et al., 2020). From the findings, the mean value, 4.22 indicates that students had good exposure and understanding that the construction site is the most hazardous and dangerous workplace. As stated by Soeiro et al. (2020) construction sites are dangerous and full of hazards and risks, therefore awareness and early detection of hazards should be exposed to these groups of students. This provides the faculty's management an insight on the students' perspective towards this field. This is important as this group of students are required to enrol in the industrial training course during their final semester of diploma programme.

However, students are almost unsure whether Safety and Health Officer (SHO) is the only person in charge of safety aspects at site. This is indicated by the lowest mean value 3.35 gathered from the analysis. This aspect needs to be enhanced amongst students as hiring a SHO is one of the important aspects highlighted in the OSHA 1994 as to prepare a safe workplace. Students' knowledge should also be enhanced on the aspect of budget allocation as some costs are also required to be allocated for safety and health aspect as well as the roles of the Department of Safety and Health (DOSH) in enforcing safety rules and regulations. This is because, in Malaysia, the DOSH is the responsible party to enforce safety rules and regulations which need to be complied by the construction practitioners specifically for the safety and health of the workers and public. The elements of Site Safety Management are ranked according to the RII values as shown in Table 6.

Table 6. Relative importance index of the site safety management

Element	Site Safety management	Frequency					Mean	RII	Rank
		5	4	3	2	1			
1	Safety & Health Officer is the only person in charge of safety aspects at site	8	39	33	15	3	3.35	0.669	9
2	Hazards need to be eliminated/minimized during construction design stage	25	48	16	8	1	3.90	0.780	8
3	All workers are compulsory to attend a safety induction course before entering the construction site	53	36	9	0	0	4.45	0.890	1
4	The construction site is the most hazardous & dangerous workplace	38	45	14	1	0	4.22	0.845	3
5	All activities at the site need to comply with the requirement of OSHA 1994	19	54	25	0	0	3.94	0.788	6
6	The enforcement of safety rules & regulations is done by the Department of Safety & Health (DOSH)	20	51	27	0	0	3.93	0.786	7
7	Effective communication between workers at all levels influence safety performance at site	42	46	10	0	0	4.33	0.865	2
8	Managerial & technical supervision is required to be conducted by a competent person	30	54	14	0	0	4.16	0.833	4
9	A high amount of cost needs to be allocated for construction safety & health aspect	27	44	24	3	0	3.97	0.794	5

4.6 Average Mean and Relative Importance Index Analysis on Site Safety Practices

Site safety practices are the parameter to measure successful project delivery which is the most paramount to the client because they greatly influenced the achievement of efficiency and effectiveness amongst professionals and even workers in the construction industry (Famakin & Fawehinmi 2012). In this study, there are nine site safety practices have been highlighted. The RII value of all site safety practices is more than 0.8 as shown in Table 7. Besides, the mean values of all safety practices are more than 4 which indicate that all respondents acquire a high level of awareness towards each site safety practices. The establishment of Occupational Safety and Health policy and preparation of the Hazard Identification Risk Assessment and Risk Control (HIRARC) shows the lowest average mean value even though these two aspects are amongst the most important aspects to be implemented in a construction project. According to Asmalia et al. (2016), HIRARC has taken on a critical role as a result of the company's emphasis on preventative actions as a mean of complying with OSH regulations. Therefore, students must be given more exposure to this aspect during the teaching and learning process by introducing the component of OSHA 1994 acts and HIRARC guidelines.

A case study by Keng and Razak (2014) found that the construction company needs to allocate a high budget to provide their workers with the safety protective equipment, safety induction courses and safety training to improve the awareness among their workers about safety when conducting work at the construction site. However, it can be considered a beneficent cost as if the accident occurs at the site, it can bring more loss to the company. An accident at the site can cause a delay of the project, which has a direct and indirect effect on the cost of construction itself.

Table 7. Relative importance index of the site safety practices

Element	Site Safety Practices	Frequency					Mean	RII	Rank
		5	**4**	**3**	**2**	**1**			
1	Establish the Occupational safety and health policy	23	57	17	1	0	4.04	0.808	8
2	Prepare the Hazard Identification Risk Assessment and Risk Control (HIRARC)	22	56	19	1	0	4.01	0.802	9
3	Employers send workers for occupational safety & health course/training	36	50	12	0	0	4.24	0.849	4
4	Install adequate safety signage on the construction site	31	55	12	0	0	4.19	0.839	6
5	Workers wear Personal Protective Equipment (PPE)	44	37	17	0	0	4.28	0.855	3
6	Accidents at the site need to be reported and recorded	58	30	10	0	0	4.49	0.898	1
7	Conduct toolbox meetings	31	48	19	0	0	4.12	0.824	7
8	Keep machinery/plant in top-notch working condition	40	47	10	1	0	4.29	0.857	2
9	Proper housekeeping	39	42	16	1	0	4.21	0.843	5

4.7 Average Mean and Relative Importance Index Analysis on Site Accident Implication

Accident events at the site can bring negative implications and more loss to the project's stakeholders. An accident at the site can cause a delay of the project, which has a direct and indirect effect on the construction cost itself. Therefore, other than identifying the causes of construction accidents, it is important to scrutinize the implication of construction accidents. Based on the mean average analysis, respondents agreed with all site accident implications highlighted in this study as shown in Table 8. This shows that students have good knowledge and understanding on this aspect which may be faced by the stakeholders involved in a construction project if an accident occurred at a work site.

Next, the accident implication was ranked according to the RII value. From the analysis, it shows that students were more concerned about the reputation of the company which might be affected and the hospitalization expenses which need to be borne by the parties once an accident occurred. Meanwhile, students show a lack of understanding on the issue where the accident may affect the project's schedule which is related to material damage or loss and productivity and financial losses. This implication is more significant which always concern the practitioners in the real situation. Therefore, the understanding of construction site accident implication concept needs to be enhanced amongst the students during the teaching and learning process. This is part of integrating sustainability knowledge into university education as it will inevitably lead students to work towards sustainable development goals in the future. (Zhou et al., 2022).

Table 8. Relative importance index of the implication of accident at site

Element	Site Accident Implication	Frequency					Mean	RII	Rank
		5	4	3	2	1			
1	Impairing reputations or the image of the company	32	49	16	1	0	4.14	0.829	1
2	Productivity and financial loss	22	52	21	3	0	3.95	0.790	9
3	Imposing psychological burden on workers and victims	30	47	18	3	0	4.06	0.812	5
4	Material damage or loss	26	49	20	2	1	3.99	0.798	8
5	Equipment damage or loss	28	50	18	1	1	4.05	0.810	6
6	Interrupting construction schedule or progress	32	47	17	0	2	4.09	0.818	3
7	Incurred high legal costs	29	43	24	1	1	4.00	0.800	7
8	Incurred insurance claim	30	47	20	0	1	4.07	0.814	4
9	Hospitalization expenses	31	48	18	0	1	4.10	0.820	2

5. Conclusion

This study aimed to investigate the knowledge and awareness amongst civil engineering students towards construction site safety, while fostering their psychological readiness on the safety aspect before enrolling in the industrial training courses during the final year of the diploma programme and involvement in the construction industry once graduated. The briefing sessions which emphasize on the safety aspects by the lecturer before starting each class such as lecture, tutorial or laboratory session provide exposure to students on this aspect. Therefore, these practices need to be implemented consistently by the lecturers from time to time. Most students gained a better understanding of safety aspects from the laboratory-based course compared to theoretical and calculation-based courses. This provides better insight for the lecturer in charge of laboratory courses to keep highlighting the safety aspects by relating the content and topic in the teaching and learning process with the real situation in the construction industry.

Majority of the respondents have adequate level of understanding towards construction site safety management, construction site safety practices and construction site accident implication. In addition, there is no significant difference between female and male students on the construction safety knowledge and awareness. Both groups of students have a high level of knowledge of the site safety management and site accident implication. It also shows that students are aware of the elements of safety practices implemented at the construction site. However, some elements of safety management were not fully understood by this group of students, specifically on the person in charge of safety aspects at site. Students have a lack of knowledge on the roles of Safety and Health Officer (SHO) at the construction site. Nearly 20% of the respondents were unsure that a SHO is the only person in charge on safety aspects at construction sites. Besides, for elements under safety practices, students have lack of knowledge on the safety and health policy and Hazard Identification Risk Assessment and Risk Control (HIRARC) aspects. Meanwhile, approximately one quarter of the respondents were neutral or disagreed that site accidents can cause material damage or loss as well as loss of productivity and

financial even though these elements are listed as the most important accident's implication faced by the stakeholders in reality.

Findings of this study indicated that students should be exposed to a complete construction safety education before entering the real construction industry. It is essential so that students can develop safety skills and competencies, up to a certain level which can meet recent project safety requirements. This study may provide supplementary information to the faculty as the basis to review the curriculum of Civil Engineering Diploma programme. The construction safety education could be embedded in the syllabus as these future graduates will take up the front-line responsibilities in improving safety performance in Malaysian construction sites. Besides, this is important in improving the humanity aspect as this group of students will expose themselves in the most hazardous workplace in the future. This also offers a better insight to the faculty in assisting any decision made to plan any activity to be integrated in the course. Apart from that, the faculty can also take into consideration to conduct a series of site visits as one of the enhancement activities in the teaching and learning process to increase the safety and health knowledge amongst students. This approach is preferable by the majority of the students and has considerable benefits for the students since it might improve the knowledge of potential risks and hazards at construction sites and help students become more self-aware of their surrounding working conditions. This is crucial to avoid any mishaps that might result in serious injuries or fatalities and simultaneously, it may boost the local construction industry's performance in terms of occupational safety and health.

6. Suggestion for Future Research

The study will be expanded to year three of students in order to investigate if there are any differences on the level of knowledge and awareness related to the construction safety management, practices and accident implication. Investigation on the course syllabus and content also can be conducted as this aspect might be a factor which influenced student's exposure to construction safety.

7. Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. All authors were involved in the conceptualization of the study and carried out the fieldwork. Author[1] designs the methodology, prepares the survey tool, data entry, statistical analysis and writes original data. Author[2] oversees the project administration and monitors the data collection. Author[3], Author[5] and Author[7] overlook the write up of the whole article and conduct review and editing. Meanwhile, Author[4] and Author[6] prepare the literature review.

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