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Effectiveness of Personal Protective Equipment (PPE) at Construction Site

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Abstract

It is axiomatic that, most cases in regards to the accidents around the vicinity of construction site has always been happening in Malaysia. In fact, we had collected and accumulated the data through questionnaires surveys with the Grade 7 contractors. In which, they are all with licence and registered under Construction Industry Development Berhad (CIDB) at Petaling Distinct. Seemingly, accidents tends to happen at the construction site due to the cause of improper usage of personal proper equipment (PPE) and the stubbornness in refusing to wear the personal proper equipment (PPE). Notably, this research is served to raise an awareness to the workers and employees respectively, in order to encourage them for using the appropriate equipment in proper. Certainly, there are several ways to strategize on giving an encouragement and awareness among the workers and employees, that includes (i) Providing them a proper training of using the equipment, (ii) Select the suitable PPE based on the relevant tasks given and (iii) Maintenance of the PPE. Ultimately, the risk of fatal accidents that happens at the construction sites will diminished and reduced by way of the usage of PPE. Indeed, the effectiveness of PPE may seems to be convinced, however, that could depends on the experiences, capability, knowledge with skills, attitude and belief of the workers and employees in regards to the use of PPE at construction sites. Solely, by way of prevention and deterrence, it will reduce the amount of construction site accidents and ultimately broaden their horizons on the usage of PPE. Doubtlessly, this research can be used as a reference source in the site for safety precaution.

Keywords

Awareness, Effectiveness, Personal Protective Equipment (PPE), Safety

Introduction

Malaysia country in construction line is one of the huge construction industries. The construction is impermanent and changeable (Mohd kamar,2014). Therefore, construction site is the most dangerous place because of high fatality or accident are involved in the construction activities. Nowadays, many construction labours killed or wounded per annum because of impropriate way to use and wear the personal protection equipment (PPE) while doing their task in construction site (K.Goh,2016).

Based on the global statistic, there had been an estimated 2 million people worldwide that had been deemed disabled due to work related injuries annually where 25% or more would be caused onto the head, eyes, hands and feet (C.herzberg,2013). This is caused by the lack of knowledge and the utilization of safety equipment in such as hard safety helmets that are only

being used by 16% of those that had sustained head injuries from the working environment. Furthermore, there only 1% of every 770 workers that had suffered from face injuries due to not wearing face protection. Moreover, there had been 23% of workers that suffered from foot injuries that had worn the safety boots. In addition, there had been 40% of workers that had suffered from eye injuries that had worn eye protection (C.herzberg,2013).

Based on the statistics that had been gathered, it had been proven that the there is no guarantee that the personal safety equipment would be able to prevent the accidents that would result in injuries from happening but would be able reduce the possibilities for it to happen (R.Hrynyk, 2015). According to Rosli Ahmad, precise safety applications could help in lowering accidents at construction sites and also to reduce production prices, growth productiveness and profitability as well as it has extra importantly that can save lives of people.

Problem Statement

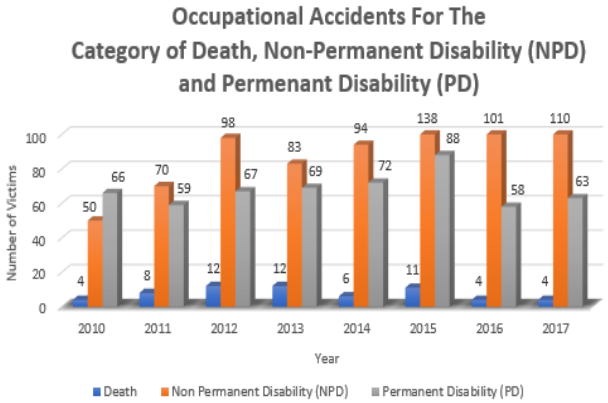

Figure 1: Number of victim's accident in the construction sites from year 2010 until 2017 .

From the figure 1, it shows that the accident causing to death is the highest in year 2012 and 2013. Meanwhile, as for Non-Permanent Disability (NPD) and Permanent Disability (PD) the accident occur is more in year 2015 respectively. The problem that causes increased the number of accident in the construction site is due to lack of training for the workers regarding personal protective equipment (PPE), misunderstanding between supervisor and worker, improper way to use and wear personal protective equipment (PPE) [8]. Furthermore, another big issued that will cause accident which is attitude of the workers. Some worker thinks they're operating in a very safe condition, therefore they will ignore the safety protection on site needed by laws and rules [9].

Besides that, the language and literacy is also very important for the safety [10]. Therefore, company need to additionally provide safety brochure with the types of the safety equipment to all labour and show the safety notice on the notice board, written in their language which is English, Malay and Bangladesh or Myanmar due to language barrier [11]. The brochure consists of images and animations indicating unhealthy and smart practices at construction sites and it will get attention-grabbing and easier to know by the employees [12].

Objectives

In line with the efforts to reduce accidents at construction sites in Malaysia, this research is carried out with the objectives to identify awareness of using personal protective equipment (PPE) at construction site, determine the effectiveness of using personal protective equipment (PPE) at construction site and to investigate the level of usage for personal protective equipment (PPE) in construction site.

Literature Reviews

Previous researches were reviewed by the researcher. The literature review was mainly focusing on awareness of using PPE and effectiveness of using PPE at the construction site

Awareness of using personal protective equipment (PPE)

According to Mitchell and Braithwaite stated that training of the workers to utilize the personal protective equipment (PPE) at the construction site is one of the essential processes or compulsory requirement that the construction company would have to prepare for the workers before allowing the workers to begin working. Furthermore, training provide the workers is to ensure that the workers are well-equipped with the knowledge to carry out the work at the construction site with minimal safety hazards (T.Smith,2014) . Training would be effective when there are two ways effort which are informational based as well as hands-on approach whereby the workers would have to try the personal protective equipment (PPE) by themselves for the worker to gain a better understanding and awareness regarding the personal protective equipment (PPE) (M. Cooper, 2012). For examples, the construction company would have to prepare a test or observe the use of the personal protective equipment (PPE) for a time period before the workers are being qualified in having the full awareness regarding all of the aspects that are present in the personal protective equipment (PPE) at the construction site (E.Cheng,2014).

Based on Cheng et al., the awareness of the personal protective equipment (PPE) would also include the selection of the suitable and relevant personal protective equipment (PPE) that would be able to minimize the safety hazards that are threatening the safety of the workers. For tasks such as welding, the employer must provide for the construction worker a suitable and relevant PPE which as safety masks, safety gloves and protective clothing is necessary to prevent sparks or other particles to come in contact with the face, body and hands of the worker (Z.Riaz, 2017).

According to Pheng and Shiua (L,pheng, 2014), the maintenance and surveillance of the personal protective equipment (PPE) at the construction site is important as well. This would be because the personal protective equipment (PPE) would have to be ensured regarding its quality and consistent function which is to minimize the hazards that the worker is facing at the construction site. According to Karimi et al. , the personal protective equipment (PPE) needs to be constantly checked by the workers as well as their supervisors to ensure that it is in full functioning condition. The workers need to be aware regarding each of the different methods that are present to check and maintain the personal protective equipment (PPE) in which it would be in good condition and ready for use by each of the different workers at the construction site.

Effectiveness of using PPE at construction site

According to Spillane and Oyedele , the effectiveness of using the personal protective equipment (PPE) at the construction site would also depend on the experience of the workers to use the personal protective equipment (PPE). As identified by Hare and Cameron workers that are well experienced with the usage of the personal protective equipment (PPE) at the construction site would know what to do, how to use it as well as maintaining the functions of the personal protective equipment (PPE). Workers that have the experience would have a positive effect at the construction site as well because these workers would be able to supervise the usage of the personal protective equipment (PPE) at the construction site by the other workers that are present. This would enhance the effectiveness of using the personal protective equipment (PPE) at the construction site.

According to Adeyemi et al., the effectiveness of the usage of the personal protective equipment (PPE) at the construction site would be able to prevent and minimize the rate of accidents that are present at the construction site. As identified by Adebiyi and Owaba the effectiveness would also depend on the ability of the workers to determine themselves regarding the fitting of the personal protective equipment (PPE) for their personal use. Personal protective equipment (PPE) that does not provide a good fit would allow the hazardous material to come in contact with the user of the personal protective equipment (PPE) The workers would have to constantly evaluate themselves regarding the fitting of the personal protective equipment (PPE) to ensure that the workers would have lesser probability of exposing themselves towards the hazardous materials at the construction site (adebiyi,2013).

The worker knowledge, attitude and belief regarding the use of the personal protective equipment (PPE) in the construction site would also affect the effectiveness of the personal protective equipment (PPE) being used at the personal level. According to Pomevor and Afari, a positive working environment accompanied with workers that are knowledgeable and have a positive attitude and belief regarding the personal protective equipment (PPE) would bring a healthy working condition for the worker. As identified by Edwards and Holt the workers would carry out their job effectively and efficiently which might be useful for the employer. This might speed up the process of completing the project at the workplace as well which might allow the employer to receive the payment for completing the project because there would not be any delays or additional cost due to the accidents that might happen.

Research Methodology

In this chapter, it is to analyse collected data from respondents as to achieve aim and objectives in this research. Quantitative questionnaire survey is the method of data collection and the respondents is focus to the contractor grade 7 which fully registered under Construction Industry Development Board (CIDB) in Petaling Distinct. Furthermore, the details on the data analysis and findings on each question set in the Google Form. The questions asked in the questionnaire are based on a likert scale and open ended question. Likert scale questionnaire require each respondent to rate the statement on a 5-point. Such as scale 1 = strongly disagree, scale 2 = disagree, scale 3 = neutral, scale 4 = agree, and scale 5 = strongly agree.

Data Analysis and Findings

Figure 2 shows that, the responses received from different professionals in the contractor firms. From the result, project manager contributes the highest rate of 29% of the survey, then followed by site supervisor and site manager which is 26% and 25%. The information received are sufficient and useful to this research because the respondents involved in the survey have the experienced to deal with the site safety problem.

Figure 2: Designation of respondents

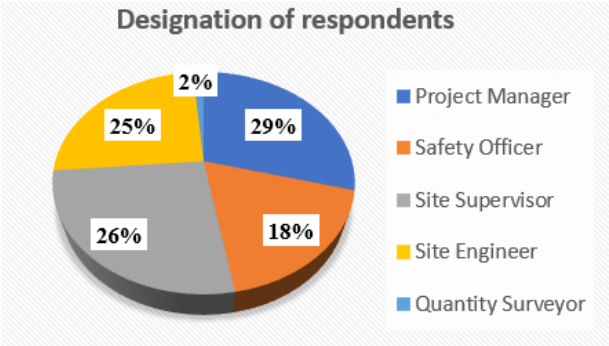

Table 2: Awareness of using PPE

Awareness of using personal protective equipment (PPE)	**Mean Score**	**Rank**	**Rating**
Personal Protective Equipment (PPE) is important in the construction.	4.11	1	Agree
The supervisors are encouraging to wear Personal Protective Equipment (PPE) at the construction site.	3.89	2	Agree
The safety officer conduct the training of Personal Protective Equipment (PPE) for the workers	3.79	3	Agree
The workers would be fine or punishment for not wearing the Personal Protective Equipment (PPE) in the construction site.	3.74	4	Agree
The Personal Protective Equipment (PPE) be able to prevent injuries at construction site	3.71	5	Agree

The workers are aware of the usage and importance of the Personal Protective Equipment (PPE).	3.64	6	Agree
The workers are aware of the danger that are present at the construction site	3.56	7	Agree
The workers are being constantly updates regarding the usage of the Personal Protective Equipment (PPE)	3.51	8	Agree
The workers would be able to check and maintain their own Personal Protective Equipment (PPE)	3.46	9	Agree

The respondents who have served in the construction for many years will have a certain level of professional knowledge, maturity and ability to provide data for this research which showed in the table 1. The highest percentage of respondents answered this questionnaire are from the company established for 2-5 years which represent 51%. While the lowest percentage is the company establish for a period less than 2 years which represent 2%.

Table 1: Respondents working experienced in construction site

		Total	**Percentages**
Years	Less than 2 years	1	2%
	2-5 years	37	51%
	5-10 years	13	18%
	10-20 years	21	29%
	More than 20 years	0	0%
	Total	72	100%

Awareness of using PPE

Table 2 shows the level of awareness of contractors on using the Personal Protectives Equipment (PPE) in construction site. Based on the table, most of them aware PPE are very important in the construction site (4.11). All the respondents are aware regarding the dangers that are present at the construction site is as important as the usage of the personal protective equipment (PPE) at the construction site (Muhaimin, 2014).

Moreover, the supervisors are encouraging to wear Personal Protective Equipment (PPE) at the construction site (3.89) is the second high mean score and it followed by the safety officer conduct the training of Personal Protective Equipment (PPE) for the workers (3.79). Based on the result, contractor had understand and supported that training had been regarded as one of the compulsory measures or requirements that the construction companies would have to provide for the workers as well to ensure that the workers are well-equipped with the knowledge to carry out the work at the construction site with minimal safety hazards (T.Smith,2014).

Effectiveness of using PPE

Table 3, shows the effectiveness of using Personal Protective Equipment (PPE). The highest score means (3.90) of the respondents aware and agree that the number of accidents at the construction site had been reduced due to the usage of the Personal Protective Equipment (PPE) and it followed by the the Personal Protective Equipment had prevented accidents at workplace (3.85). According to Kearney proved that the dangers at the construction site without the use or lack of use of the personal protective equipment (PPE) might be exposed to the worker that might cause the workers to suffer from temporary till permanent disabilities or sometimes death. So, this mean that the Personal Protective Equipment (PPE) will reduce the number of accident and prevention of the accident on the site.

The condition of the Personal Protective Equipment (PPE) had been maintained well is the third highest score which is 3.81. According to Karimi et al , the maintenance of the overall personal protective equipment (PPE) that is present at the construction site needs to be monitored by a certified supervisor in which it would be able to undergo certain tests that it would be qualified for use by the workers. This result can showed that if the workers had maintain their own Personal Protective Equipment (PPE) in good condition, the worker can use it longer and safely.

Lastly, the lowest rank that agreed by the contractor which is "The supervisors have the rights to randomly check on the maintenance of the Personal Protective Equipment (PPE) for the workers" and score is 3.53. This statement in the rating rank still agree by the contractor, so that it can included in the effectiveness of using the personal protective equipment (PPE).

Table 3: Effectiveness of using PPE

Effectiveness of using personal protective equipment (PPE)	**Mean Score**	**Rank**	**Rating**
The number of accidents at the construction site had been reduced due to the usage of the Personal Protective Equipment (PPE).	3.90	1	Agree
The Personal Protective Equipment had prevented accidents at workplace.	3.85	2	Agree
The condition of the Personal Protective Equipment (PPE) had been maintained well.	3.81	3	Agree
The Personal Protective Equipment (PPE) being tested constantly for its function before use in the construction site.	3.71	4	Agree

There is relevant Personal Protective Equipment at the construction site for each of the tasks.	3.63	5	Agree
The supervisors have the rights to randomly check on the maintenance of the Personal Protective Equipment (PPE) for the workers	3.53	6	Agree

Level of usage for personal protective equipment (PPE) in construction site

In table 4, the highest two rank of the types of the personal protective equipment (PPE) which is 4.33 and 4.31 for the safety helmet and safety boots. This two types of the PPE is always use by all respondents. For the third, fourth and fifth ranked of the types of the PPE which are safety harness (3.81), protective clothing (3.64) and gloves (3.57). Besides that, the two lowest ranked which is safety googles (3.33) and nose mask (2.63). In a nutshell, the respondents between G7 contractor had define that the types of the PPE that more using on the site which is safety helmet and safety boots.

Table 4: Types of PPE

No	Types of PPE	Mean Score	Rank	Rating
T1	Safety Helmet	4.33	1	Always
T2	Safety Boots	4.31	2	Always
T7	Safety Harness	3.81	3	Often
T5	Protective Clothing	3.64	4	Often
T3	Gloves	3.57	5	Often
T4	Safety Googles	3.33	6	Sometimes
T6	Nose Mask	2.63	7	Sometimes

In the table 5, the result is most of the contractor answer with neutral in rating range with the options provided which is restriction of movement (3.33), uncomfortable (3.22), too heavy (3.06) and not give instruction (2.56). This is because the contractor also not clear and understand why their own worker refuse to wear PPE in the construction site although the PPE is provided.

Besides that, the G7 contractor are not agree that not suitable size and unattractive for the reason by the general workers, which score 2.56. This is because if the worker know the

serious accident happen will occur on the site due to not wear PPE, the unattractive of the PPE are not the reason for the worker refuse to wear PPE in the construction site.

Furthermore, the contractor are not agree of the reason about the not suitable size. According to the Hosier, the safety officer will let the workers test it and choose the prefer PPE which is fit the size of worker before enter the site or doing the tasks so they will wear it oftenly. Therefore, that is not the reason for worker say it that it is not suitable size for them.

Table 5: Reason of the worker that not wearing PPE

No	Reason of the worker that not wearing PPE	Mean Score	Rank	Rating
R6	Restriction of movement	3.33	1	Neutral
R3	Uncomfortable	3.22	2	Neutral
R5	Too heavy	3.06	3	Neutral
R1	Not give instruction	3.03	4	Neutral
R4	Unattractive	2.56	5	Disagree
R2	Not suitable size	2.56	5	Disagree

Conclusions and Recommendations

In the conclusion, all of the objectives are achieved in this study. The three objectives of the study as follow:

(i) To identify awareness of using personal protective equipment (PPE) at construction site
(ii) Determine the effectiveness of using personal protective equipment (PPE) at construction site
(iii) To investigate the level of usage for personal protective equipment (PPE) in construction site.

Based on the result and data analysis, it can conclude that the awareness and the effectiveness among the participant in construction industry not yet achieve the high awareness, but based on the rating in the first and second objective (Table 2 and 3) showed that it is under agree.

Through out of the study, the third objective that safety helmet and safety boots are the highest rank in this research, this is mean that the contractor always uses this both equipment in the construction site. From this result shows that, it already aware of using personal protective equipment (PPE) and know the important of personal protective equipment (PPE) to reduce the accident in construction that demonstrate in 6.1 and 6.2.

Even though, some other equipment had not been used often or always such as nose mask and safety google. Both equipment is importance personal protective equipment (PPE) because most worker involved in the dirty environment such as smoke or dust that will influence the worker and danger themselves. From the findings, the reason of worker that refuse to wear the nose mask and safety googles is because the workers feel uncomfortable and restriction of movement when they are doing their task.

The recommendations for further research which are the location that are focus at the Petaling Distinct, Selangor can be proceed on other country as it may turn out various outcome and discoveries for the awareness of using the personal protective equipment (PPE). Moreover, it is suggestion to supersede the questionnaire survey by using the cases analyses or in-depth consultation. In the consultation, information and data gathered will be more exact. Unlike conduct the thesis predicted on the questionnaire survey only, which may collect some incorrect information. In addition, this dissertation also can proceed for the various population of professional excluding for G7 contractor such as architect, quantity surveyor and others. They may have different perception for the awareness of using personal protective equipment in construction site, Malaysia.

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