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Assessment of Nonverbal Safety Training for Construction Novices: A Comparative Experiment in Japan and Malaysia

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Abstract: Safety and health training for construction novices is becoming increasingly important to prevent work-related accidents in construction projects, both in developed and developing countries. A comparative experiment was conducted on 100 undergraduates studying the basics of construction management in Japan and Malaysia to compare the effectiveness of the teaching methods among the students in both countries. Statistical analyses were performed on Statistical Package for the Social Sciences (SPSS) 16.0. Although basic safety training, such as the use of personal protective equipment and lifting operations, can be emphasised verbally or nonverbally during regular training, safety training related to high-risk activities, such as work at height (WaH), was more effective when conducted through nonverbal methods. According to the study's findings, the nonverbal method resulted in fewer variations in understanding among students than the verbal method, regardless of their nationality, as construction novices scored higher points after nonverbal training. The study concludes that nonverbal safety and health training methods are effective for training construction novices. It is recommended that governments or relevant authorities design nonverbal safety teaching content related to construction safety based on the prevailing conditions in the country.

Keywords: Nonverbal safety training, Construction safety, Novices, Japan, Malaysia

INTRODUCTION

The construction industry is hazardous because of the complexity of the working environment (Fang and Wu, 2013) and the heavy reliance on the migrant workforce (Ismail et al., 2018). In addition, nearly 80% of fatal construction accidents are caused by unsafe worker behaviour (Liu and Tsai, 2012; Li et al., 2015; DOSH [Department of Occupational Safety and Health], 2020). A lack of safety training negatively affects construction safety performance (Priyadarshani, Karunasena and Jayasuriya, 2013). Young workers (18 years old to 24 years old) are vulnerable to safety problems and accidents in the workplace due to inadequate safety and health training and a lack of safety awareness (Ajslev et al., 2017; Hanvold et al., 2019). There are also challenges on construction sites such as language barriers (Oswald et al., 2019) and different cultures of safety. In short, although the construction industry only

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accounts for 5% to 10% of workforce employment, it has a high rate of recorded accidents, accounting for 30% of all fatal occupational accidents globally (ILO [International Labour Organization], 2021).

Prior research has conducted preliminary studies on the level of effectiveness of safety training assessments, focusing on monitoring the effectiveness of safety training from both organisational and worker perspectives, to help organisations better understand what makes training effective or ineffective (Vignoli, Punnett and Depolo, 2014). However, the effectiveness of safety training methods and their implementation in the construction industry remains controversial owing to weak safety culture, unclear worker attitudes and a lack of understanding regarding safety training programmes (Ajslev et al., 2017). Also, current safety training settings fail to develop the necessary risk awareness among construction workers (Albert, Hallowell and Kleiner, 2014; Albert et al., 2014). Existing safety training methods in developing countries tend to be low-engagement methods as some researchers argued that low-engagement methods such as video demonstrations are not ideal for educating construction workers (Guo et al., 2012). Moreover, safety training for construction workers is voluntary in the Malaysian construction industry, which may lead to a high incidence of construction accidents, especially among novices such as university students who may be young and inexperienced in the construction field. Therefore, safety training must be implemented as early as possible before working at construction sites to improve worker risk identification (Cheng and Wu, 2013).

There is limited research on the content and methods of novice construction safety training and the effectiveness of such training methods. Nonetheless, it is important to examine whether the use of nonverbal safety training content is effective in enhancing construction safety awareness among construction novices (even if they have no on-site experience) and whether it helps to develop risk identification skills that current safety training settings fail to do. Therefore, this study aimed to assess the effectiveness of safety training materials for construction novices. The study objectives were: (1) to identify safety training content that would enhance novices' understanding of safety knowledge on construction sites and (2) to compare effective teaching methods used among construction novices from different countries of origin to achieve a certain level of safety knowledge. The following section describes the current status of construction safety training in developed and developing countries and the safety training content and methods used in the construction industry.

LITERATURE REVIEW

Construction Safety Training in Developed and Developing Countries

In 1996, Japan's construction accident rate (per 1,000 employees) was recorded as 7.26 and the rate declined to 4.50 in 2019 (JISHA [Japan Industrial Safety and Health Act], 2020). In Malaysia, the number of construction accidents increased by almost 41% from 232 cases in 2018 to 326 cases in 2019 after the launch of the *Occupational Safety and Health Master Plan 2016–2020* (DOSH, 2018). This finding is supported by several studies that investigated the safety and health performance of developed and developing countries (Teo, Theo and Feng, 2008; Raheem et al., 2011), in which the results have shown significant differences in accident rates.

Japan has made remarkable improvements in safety and health by reducing accident rates. This improvement is consistent with the implementation of the JISHA in 1972. For instance, Article 59 of JISHA stipulates that employers should provide all workers with construction-related safety and health education, including (1) how to handle hazardous harmfulness of materials or machinery, (2) how to use safety devices, devices that control harmful substances, or personal protective equipment (PPE), (3) operation procedures, (4) inspections at the commencement of work, (5) causes and prevention of illnesses related to the work, (6) housekeeping and cleanliness maintenance and (7) emergency measures and evacuation in case of accidents. The enforcement actions demonstrate the Japanese government's commitment to promoting safety education for construction workers, which in turn increases workers' safety awareness and reduces accidents at construction sites.

On the other hand, Malaysia's provision of the Occupational Safety and Health Act (OSHA) 1994 Act 514 is based on a self-regulatory approach. The act stipulates that employers should provide the necessary training to employees. In addition, the Malaysian *Guidelines on Occupational Safety and Health Management Systems* (DOSH, 2011) states that organisations should develop their own safety training modules on specific topics, with the help of qualified personnel, for workers. However, the standards for construction safety training are low, and the contents of necessary safety education are not specified in the act.

Research has shown that providing safety training is effective in educating and changing worker behaviours regarding construction safety issues as the training enhances situational awareness of construction sites (Li, Chan and Skitmore, 2012a; Jeschke et al., 2017; Winge, Albrechtsen and Mostue, 2019; Vignoli et al., 2021; Wang, Jiang and Blackman, 2021). Studies have shown that a safety programme is most effective during the plan preparation and pre-construction phases; thus, it is necessary to educate construction novices beforehand (Esmaeili and Hallowell, 2012). Moreover, age is a key factor contributing to unsafe behaviours and accidents, and young people are less likely to use protective equipment (Lombardi et al., 2009). Therefore, focusing on the developmental characteristics of young workers who interact with hazards is essential in developing effective preventive interventions (Sámano-Ríos et al., 2019).

Construction Safety Training Contents

Safety training could reduce construction accidents as it enables the cultivation of a safety culture and improves the safety motivation of workers in high-risk industries (Hutchinson et al., 2022). Fall protection, PPE, tools, material handling and lifting are common concerns for large and small construction companies (Cunningham et al., 2018). However, falls from heights have the highest frequency and fatality rates among all types of accidents at construction sites. The falls are attributed to workers' unsafe behaviours, non-compliance with work-safe procedures, and improper use of PPE (Nadhim et al., 2016; Hoła et al., 2017; Zaini et al., 2020). Although falls from heights are common and critical accidents, they have not received sufficient attention from stakeholders (Nadhim et al., 2016). While taking precautions is the most important method of protection at the site, education and training are primary priorities in preventing accidents. Therefore, there is a need for effective methods to prevent construction accidents by providing safety training content for construction novices in response to these accidents.

Safety Training Methods

Various safety training methods have been introduced to shape the safety behaviours of construction workers. Developed countries, such as the United States, the Republic of Korea, and China, are developing computer software, including virtual reality technology, to facilitate learning by providing virtual environments, thereby improving learning outcomes (Teizer, Cheng and Fang, 2013; Evanoff et al., 2016; Hou et al., 2017; Li et al., 2018; Nykänen et al., 2020; Zhang et al., 2020; Zhu et al., 2022). This is because, information presented in a visual format, such as a video, is the best for stimulating learning across age groups (Wallen and Mulloy, 2006). However, the use of low-engagement methods is more common in the construction industry (Cunningham et al., 2018). Traditional safety training, also known as low-engagement methods, includes classroom lectures, videos, toolbox meetings, text-based print materials, and audio-visuals and can reduce accidents by improving workers' knowledge acquisition and by behaviour alteration (Blanchard and Simmering, 2014; Gao, Gonzalez and Yiu, 2019). The limited budgetary allocations for construction safety forces construction companies to implement such training regularly, as it sufficiently enhances workers' safety knowledge (Gao, Gonzalez and Yiu, 2019).

The use of nonverbal materials, such as short videos (with or without audio aids), for better knowledge transfer to construction novices, has the potential to address safety issues (Zujovic, Kecojevic and Bogunovic, 2021). The materials have been utilised in Japan (Ministry of Health, Labour and Welfare, 2023). Using videos to communicate safety and health information to workers onsite has proven popular among workers (Edirisinghe and Lingard, 2016) because using videos as a teaching method can aid in effectively delivering information and maximising the learning experience (Brame, 2016). Visual teaching gives the receiver a sense of reality and deepens memory. Research has shown that the use of visualisation in safety training leads to a better and easier understanding of safety content by workers and enhances their interest in safety training (Bust et al., 2008; Li, Chan and Skitmore, 2012b).

Researchers have found that younger workers, who possess less safety knowledge than experienced workers, are likely to be concerned about safety and are willing to learn (Loosemore and Malouf, 2019; Shuang et al., 2019). Thus, although effective delivery of safety training and knowledge is based on worker preferences such as age, educational background and culture (Nielsen, 2015), the lack of a uniform language may lead to miscommunication in safety education (Ismail et al., 2018; Arif et al., 2021). As low-engagement methods are common in the construction industry, they allow trainers to introduce novices to basic safety knowledge in a relatively short period, forming a better foundation for learning (Teck and Asmoni, 2015).

To the best of our knowledge, few studies have been conducted on safety training for novice construction workers. As more young workers of different nationalities join construction sites and face challenges, such as lack of experience, language barriers, and cultural differences (Li, Tang and Chau, 2019), the use of nonverbal safety training may be effective in raising safety awareness among construction workers. As part of creating a safety culture, using a combination of images and text, video lectures, and oral presentations during early safety training is essential to protect workers from construction accidents (Başağa et al., 2018). Researchers claim that safety training should be conducted in stages, beginning with the use of rational and less engaging methods to impart declarative safety knowledge (Brahm and Singer, 2013).

RESEARCH METHODS

Given that this was a cross-national experiment, the participants were volunteers who would work in the construction industry in the future and hold relevant qualifications. A total of 136 undergraduates from two institutes participated in this experiment to identify the differences in the understanding of safety knowledge among construction novices of different nationalities after receiving training using different safety training methods. A total of 71 Japanese undergraduates of Project Management in Building Construction and 65 Malaysian undergraduates of Construction Management volunteered to participate in the experiment, and their ages ranged between 20 and 24 years.

Convenience sampling was used in this study. Convenience sampling is most commonly used in the exploratory phase of research to obtain information quickly and efficiently (Sekaran, 2003). All the participants had similar educational qualifications as they studied the same courses related to building construction safety at their respective universities; thus, the study population was similar, and it was possible to draw implications about how different safety training methods affect different nationalities. In addition, sample sizes larger than 30 and smaller than 500 are considered appropriate for most studies (Sekaran, 2003). Shuang et al. (2019) conducted a similar experiment to explore the relationship between age, sex and accidental unsafe behaviours. Shuang et al. (2019) interviewed safety managers to determine their perceptions of the safety of workers of different ages and genders in the construction industry. However, this comparative approach provides insights rather than quantitative data. The quantitative approach provides a "snapshot" of the experimental data, whereas the qualitative approach helps in gaining an understanding and provides information to develop a theory (Fellows and Liu, 2022). In this study, a comparative experiment was used to compare the performance of two groups of novices (of the same age range) from different countries after receiving training through different teaching methods. As non-parametric tests do not involve distributions and are more flexible in their application, they were used to examine the similarities and differences between the two groups using a rank sum test (Fellows and Liu, 2022).

The mean scores of participants for the two safety training methods were compared, and the results were analysed using frequency statistics among the groups to interpret each question in each section. As the data from the two groups were not normally distributed (as shown in Figure 1), the Mann-Whitney U test, a non-parametric test, was used to measure the discrepancy between the mean ranks of the two groups (Fellows and Liu, 2022). The Mann-Whitney U test ranks all values ascending with a p-value; the smaller the p-value (less than 0.05), the more significant the difference between the two groups.

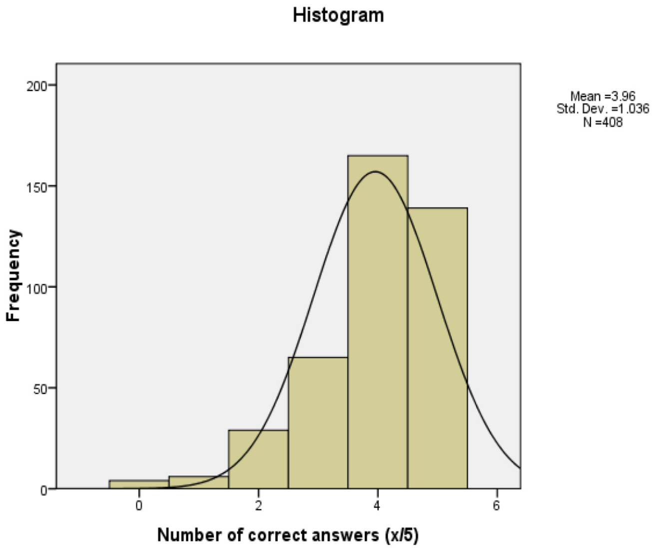

Figure 1. Overall distribution of responses

Overview of the Experiment

An experiment was conducted in two countries with a group of instructors over a specified period. The participants were categorised into two independent groups based on their nationality: Japanese and Malaysian. Japanese and Malaysian instructors introduced the experiments to participants in each group. The medium of instruction was Japanese for Japanese participants and English for Malaysian participants via the default platform. The two independent groups were further segregated into two subgroups to impart training using different training methods. For instance, one subgroup received training on a safety method with verbal explanations, texts and pictures, while the other group received training only using video content without verbal explanations or subtitles (see Table 1). Each participant was immediately assessed after the safety training. Google Forms were used for safety training assessments to control response times. Safety training and assessment for each subgroup lasted approximately one hour.

Table 1. Experiment population

Group	Population	Training Method		Total
		Verbal	Nonverbal	
1	Malaysian undergraduates	33	32	65
2	Japanese undergraduates	36	35	71
	Total	69	67	136

Rationale of the Safety Training Contents and Questions Design

The selected training content was based on common accident types and causes reported by DOSH and JISHA. The duration of safety training was positively correlated with construction risk awareness (Yao et al., 2021). The content of safety training used in the experiment was produced by Planex, Japan. It was developed based on the realities of the Japanese construction industry to suit Japanese construction practices. They may be useful for the Malaysian construction industry, as construction accidents, such as falls from height, being caught in between, or hit, or crushed, are similar in both countries.

The safety education content produced by Planex Japan consisted of 10 safety elements, each consisting of less than two minutes of content to capture students' attention and optimise learning (Brame, 2016). The contents were categorised into three sections: PPE, work at height (WaH) and lifting operations and site cleanliness. Participants received the same safety training content, such as how to wear PPE (including a safety helmet and full harness type of safety belt), how to use hand tools, how to work safely on a portable workbench, up and down work, housekeeping at the construction site and lifting operations at the site via the default platform. These topics reflect unsafe working behaviours, procedures, and site conditions, as suggested by Liu and Tsai (2012). However, as the safety training content was designed for the Japanese construction culture and given the differences in safety culture between the two countries, the training content may have created a sense of unfamiliarity for Malaysian participants and led to differences.

The assessment questions were designed according to the safety training contents produced by Planex, Japan. With reference to the *Health, Safety and Environment Test for Operatives and Specialists* published by the Construction Industry Training Board, United Kingdom (2019), multiple choice questions (MCQs) with four options were used for the assessment. MCQs are widely used in higher education because of their high reliability, rapidity and openness to item analysis (Dehnad, Nasser and Hosseini, 2014). They helped determine how well a student understood the test material and allowed students to succeed when they had the required knowledge. Three experts formulated and reviewed the questionnaire. The questions were designed according to the safety training sections (five questions per section). The questions were prepared in Japanese and English to accommodate all participants and eliminate language issues. The participants were requested to answer the questions via a Google Form provided by the instructors after the safety training. Each question that participant answered correctly, counted towards their average score for that section.

DATA ANALYSIS

The obtained data were statistically analysed using the Statistical Package for the Social Sciences (SPSS 16.0). The mean rank of the correct answers for each group with different safety training methods was analysed.

Analysis of the Findings

The test scores were compared to determine the immediate effectiveness of both training methods. First, groups' test scores of verbal or nonverbal training methods were compared. The average score of the participants in three sections out of 15 were 10.94 (Group 1 verbal), 11.34 (Group 1 nonverbal), 12.03 (Group 2 verbal) and 13.06 (Group 2 nonverbal). All participants scored 4 or more (Group 1 verbal: 4.09, nonverbal: 4.31; Group 2 verbal: 4.31, nonverbal: 4.54) on the PPE section. However, participant scores for the WaH section were less satisfactory (Group 1 verbal: 2.58, nonverbal: 2.84; Group 2 verbal: 3.28, nonverbal: 3.63). Finally, participants scored 4 or more (Group 1 verbal: 4.27, nonverbal: 4.19; Group 2 verbal: 4.44, nonverbal: 4.89) as the average score for lifting operations and site cleanliness. The average scores for the three sections are shown in Figure 2.

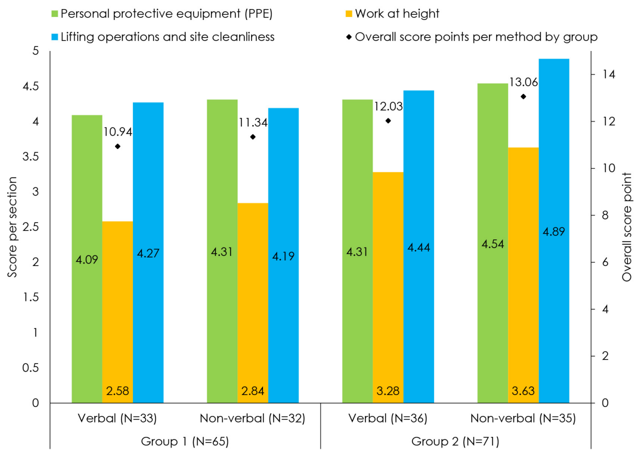

Figure 2. Overall scores for verbal and nonverbal methods

Trend of Answers Per Section

The trend of answers to questions on PPE, WaH, and lifting operations and site cleanliness are shown in Figures 3 to 7, 8 to 12 and 13 to 17, respectively. The discussion is presented accordingly.

Personal protective equipment

For the first question, "The safest way to wear a safety helmet", 88% and 94% of the participants from Group 1, and 86% and 89% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Straight and deep headgear" (as shown in Figure 3).

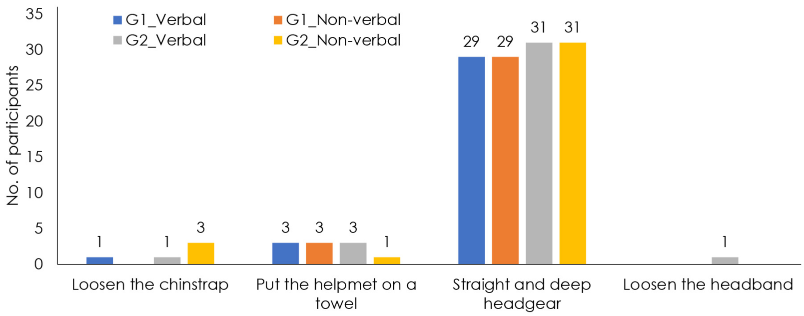

Figure 3. Safest way to wear a safety helmet

For the second question, "The safest material for work gloves", 33% and 50% of the participants from Group 1, and 56% and 74% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Leather" (as shown in Figure 4).

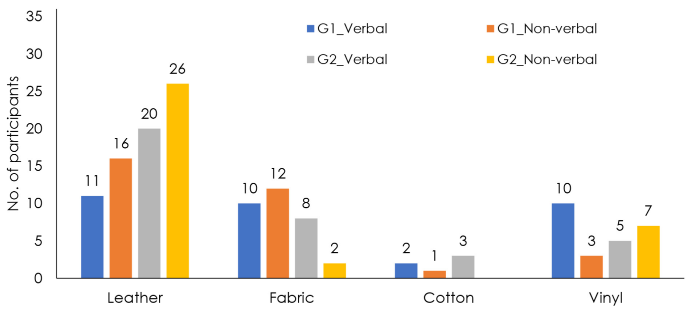

Figure 4. Safest material for work gloves

All participants correctly answered: "The most appropriate footwear for use during construction" (as shown in Figure 5).

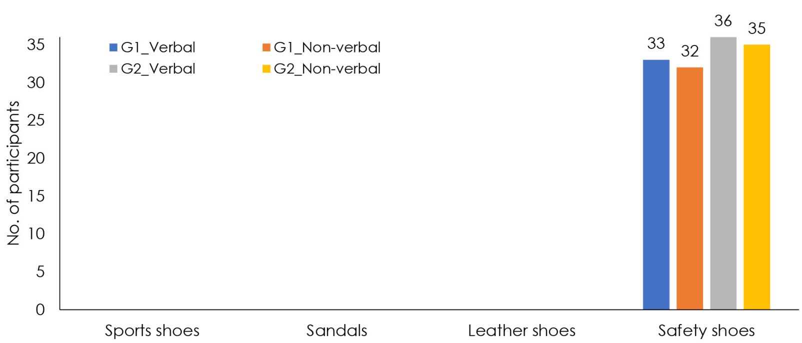

Figure 5. Most appropriate footwear for use during construction

For the question, "The most inappropriate work clothing", 88% and 94% of the participants from Group 1, and 92% and 91% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "A short-sleeved shirt" (as shown in Figure 6).

Figure 6. Most inappropriate work clothing

For the last question, "When is a safety helmet not needed on-site?", 100% and 97% of the participant from Group 1, and 97% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "In the restroom" (as shown in Figure 7).

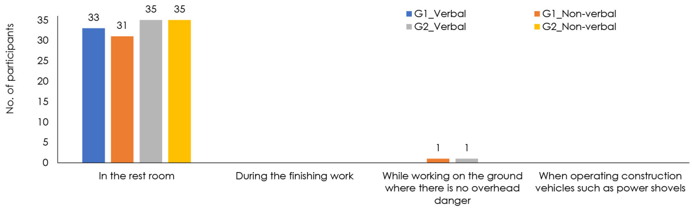

Figure 7. When is a safety helmet not needed on-site

Overall, the nonverbal training group scored higher than the verbal training group in the PPE section. Most of the participants correctly answered all four questions for the PPE section except for the question "The safest material for work gloves". Although the safety training content showed the type of work gloves to be used when performing tasks on-site, about half the participants, mainly those in the verbal groups, gave different answers—fabric, cotton and vinyl—instead of "leather".

Work at height

WaH is considered a critical risk at most construction sites. For the question, "The most inappropriate precaution to take when working on and under scaffolding", 55% and 56% of the participants from Group 1, and 69% and 86% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "You are safe if you wear a helmet" (as shown in Figure 8).

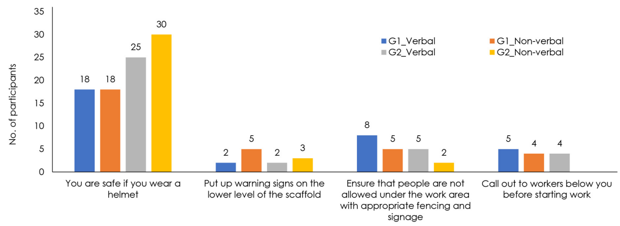

Figure 8. Most inappropriate precaution to take when working on and under scaffolding

For the next question, "The most inappropriate action when you notice that a scaffold member has come loose", 58% and 63% of the participants from Group 1, and 64% and 77% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Do nothing" (as shown in Figure 9).

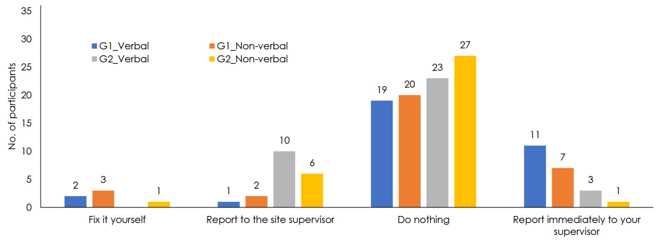

Figure 9. Most inappropriate action when you notice that a scaffold member has come loose

For the following question, "The most appropriate procedure for unloading a load after working on a workbench", 70% and 78% of the participants from Group 1, and 97% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Leave the load on the workbench and unload it after you have dismounted" (as shown in Figure 10).

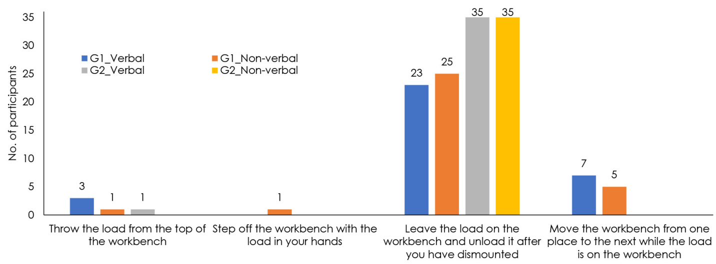

Figure 10. Most appropriate procedure for unloading a load after working on a workbench

For the next question, "The most inappropriate when working with scaffolds", 73% and 84% of the participants from Group 1, and 94% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Leaving materials on scaffolds" (as shown in Figure 11).

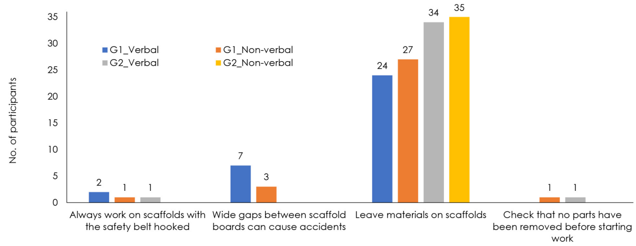

Figure 11. Most inappropriate when working with scaffolds

For the last question, "The most appropriate height for the hook of the safety belt when working on the workbench", one participant each who received verbal and nonverbal training, respectively, from Group 1 and one participant who received verbal training from Group 2 correctly answered "As high as possible" (as shown in Figure 12).

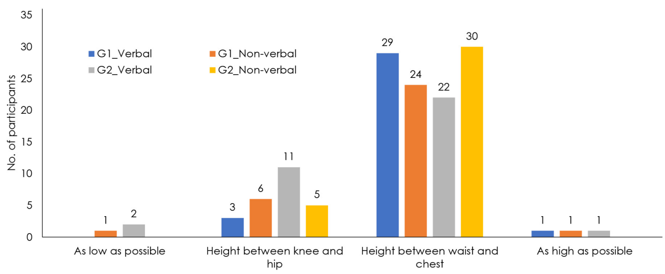

Figure 12. Most appropriate height for the hook of the safety belt

All participants obtained lower WaH scores regardless of the training method used. In response to the question "The most appropriate height for the hook of the safety belt", about 74% of the participants from the verbal training groups and 80% from the nonverbal training groups answered, "Height between waist and chest". In addition, some participants in Group 1 and Group 2 selected "Fix yourself", "Report to the site supervisor" and "Report immediately to your supervisor" for the question "The most inappropriate action when you notice that a scaffold member has come loose". Besides, some participants in Group 1 selected "Move the workbench from one place to the next while the load is on the workbench" and "Throw the load from the top of the workbench" for the question "The most appropriate procedure for unloading a load after working on a workbench".

Lifting operations and site cleanliness

Both groups scored high on questions regarding lifting operations and site cleanliness, for both training methods. For the first question, "The most inappropriate behaviour during lifting operations", 82% and 72% of the participants from Group 1, and 75% and 91% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Monitoring close to the load" (as shown in Figure 13).

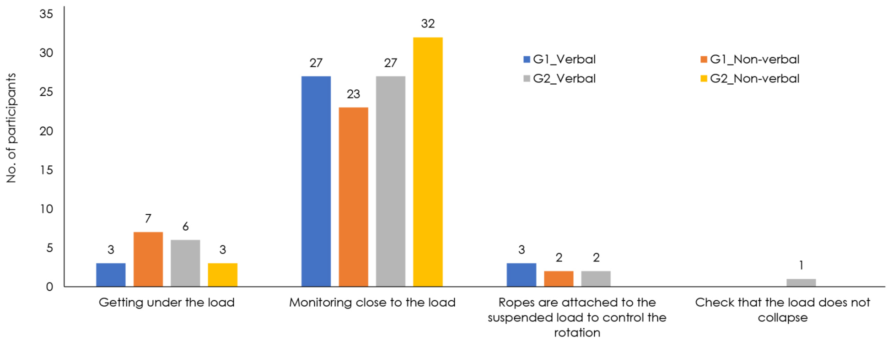

Figure 13. Inappropriate behaviour during lifting operations

For the second question, "The most inappropriate way to give instructions to a crane operator", 97% of the participants from Group 1, and 83% and 97% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Operators make their own decisions without instructions" (as shown in Figure 14).

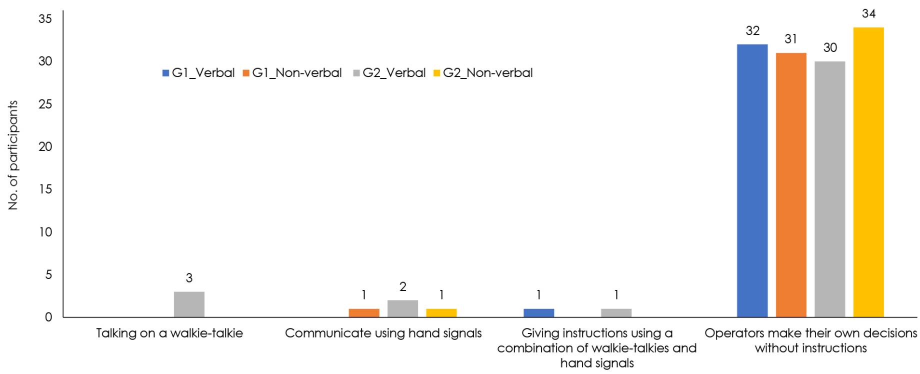

Figure 14. Most inappropriate way to give instructions to a crane operator

For the next question, "The most inappropriate reason for keeping the work area clean", 91% and 94% of the participants from Group 1, and 92% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "To run around the work area" (as shown in Figure 15).

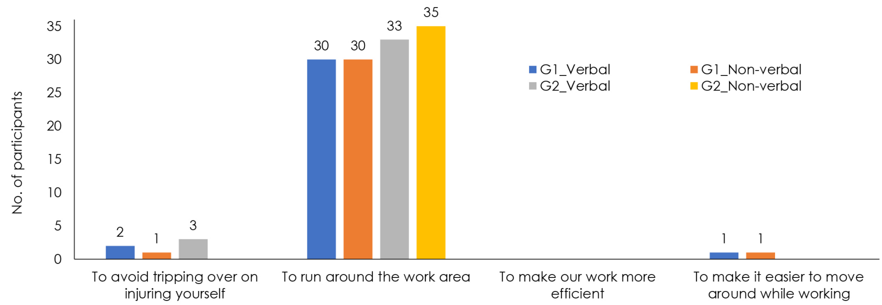

Figure 15. Most inappropriate reason for keeping the work area clean

For the next question, "Responsible for keeping the work area tidy", 97% and 94% of the participants from Group 1, and 97% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "People working on site" (as shown in Figure 16).

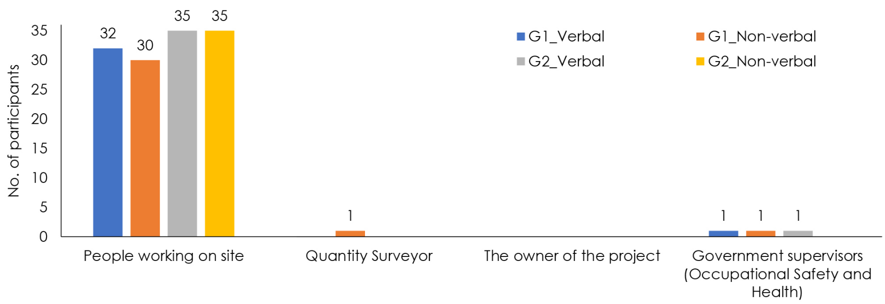

Figure 16. Responsible for keeping the work area tidy

For the last question, "The most inappropriate in relation to safety passages on-site", 61% and 63% of the participants from Group 1, and 97% and 100% from Group 2 who received verbal and nonverbal training, respectively, correctly answered "Material may be placed so as to extend beyond the safety corridor" (as shown in Figure 17).

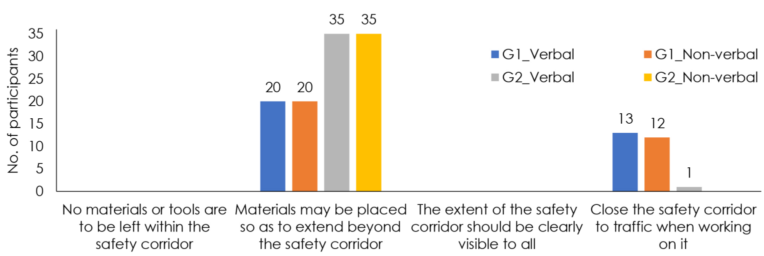

Figure 17. Most inappropriate in relation to safety passages on site

There were some differences between the participants owning to inexperience and different cultural backgrounds. For instance, some participants in Group 1 and Group 2 responded to the question "The most inappropriate behaviour during lifting operations" by answering "Getting under the load" and "Ropes are attached to the suspended load to control the rotation". Moreover, about 40% of Group 1, which received both verbal and nonverbal training, responded to the question "The most inappropriate in relation to safety passages on-site" with "Close the safety corridor to traffic when working on it". This could be due to different housekeeping practices at Malaysian construction sites. However, the difference was not significant, as participants scored well with both training methods.

Nonverbal Training Method

In terms of comprehension, the majority of participants in both training methods were able to score four or more in all three sections. Participants who received training with the nonverbal training method were able to answer the questions correctly (as shown in Figure 1). The results indicated that regardless of nationality, participants had a clear understanding of basic safety knowledge and were able to score high on all sections after receiving nonverbal safety training. Thus, the verbal method conveyed necessary information, but participants only understood it within the scope of the explanation. However, understanding the content may not be sufficient to apply the knowledge (Arif et al., 2021), especially for those with no field experience. In terms of the effectiveness of the training methods, the nonverbal method created a strong impression of the level of danger in the respondents compared to the verbal training method, thus creating interest in what was being explained and imparting relevant safety knowledge to the participants.

As shown in Table 2, no significant differences were found between the groups trained using the verbal and nonverbal methods for the PPE section; and no significant differences were found among those trained using verbal training methods between the groups for lifting operations. Based on the responses, there was no significant difference between the two groups in terms of their basic knowledge of PPE, lifting operations, and site cleanliness, and their level of understanding of safety was similar.

Table 2. Mann-Whitney U test between nationalities for both methods

Methods		**Verbal**			**Nonverbal**		
Contents		**PPE**	**WaH**	**Lifting/Sling Operations and Site Cleanliness**	**PPE**	**WaH**	**Lifting/Sling Operations and Site Cleanliness**
Mean rank	Group 1	31.44	28.56	32.76	30.73	26.98	24.17
	Group 2	38.26	40.90	37.06	36.99	40.41	42.99
Mann-Whitney U		476.5	381.5	520.0	455.5	335.5	245.5
Wilcoxon W		1,037.5	942.5	1,081.0	983.5	863.5	773.5
Z		–1.564	–2.703	–0.990	–1.477	–3.122	–4.688
p-value (< 0.05)		0.118	0.007	0.322	0.140	0.002	–

Therefore, the use of verbal or nonverbal methods for imparting safety knowledge has the same effect on novices regardless of their nationality. These training methods can impart the relevant safety knowledge to construction novices as proven by Brahm and Singer (2013).

However, there was a significant difference ($p < 0.05$) in the WaH section for the verbal training method between Groups 1 and 2, and in the WaH and lifting operations sections for the nonverbal training method between Groups 1 and 2. The answers provided by the participants from Groups 1 and 2 showed significant differences due to the different safety cultures in the two countries (as shown in Figures 8 to 12). For instance, the safe use of scaffolding and workbenches on site was unfamiliar to novices, especially those in Group 1, as they were more "uncertain" than Group 2 regarding questions in the WaH section. Most participants in Group 2 had a clear understanding of the use of workbenches and scaffolding on site, as they were commonly used at Japanese construction sites. Therefore, it is recommended that cultural differences should be considered in safety training to achieve better safety knowledge transfer.

Participants' scores were less satisfactory for the WaH section. This may be due to misunderstandings during the safety training as these participants did not have field experience in using scaffolding and wearing safety harnesses on site. As a result, the nonverbal training groups still scored higher than the verbal groups. Notably, the use of nonverbal training methods enables novices to gain safety knowledge easily and effectively. It is important to note that the safety training content used in this experiment was developed in Japan to adapt to Japanese construction practices. Consequently, it was easier for Japanese students to understand the dangers of construction sites by looking at pictures and comprehending the training content. The results showed that Malaysian students gave different answers to questions in the WaH and site cleanliness sections. Overall, Malaysian students scored slightly fewer points in all three sections compared to Japanese students when both training methods were used, as Malaysian students had a low level of safety knowledge. Owning to the uniqueness of safety culture, some safety practices were only found at Japanese construction sites; for instance, appropriate practices related to safety passages on sites may be unfamiliar to those from the Malaysian construction industry, and Malaysian students may not be familiar with the terminology used at Japanese construction sites.

As WaH is a high-risk activity on construction sites, training methods should be further improved and adapted to construction sites in both countries to enhance risk identification. Further research should focus on the contents of high-risk activities to fulfil the needs for safety culture and practices and should be produced by the country of origin to eliminate cultural differences. This will allow for better knowledge transfer for construction novices.

CONCLUSIONS

The study objectives were achieved through a comparative study. This study provides didactic findings that construction novices have a good understanding of the basic knowledge of the use of PPE, WaH and lifting operations. The safety training contents for PPE and lifting operations were useful and necessary for construction novices, irrespective of whether verbal or nonverbal methods are used, as both methods enable novices to clearly understand basic safety knowledge, regardless of nationality. Most novices were able to answer the questions correctly using these two components. It can be interpreted that there were no significant differences in basic safety knowledge between novices, irrespective of the training method. Therefore, providing construction novices with regular verbal or nonverbal safety training focused on PPE and lifting operations would be effective in educating them about safety awareness.

In terms of teaching methods, the verbal method is sufficient for basic knowledge transfer, such as PPE; while the nonverbal method is more effective for use in high-risk activities, such as WaH on sites. The use of nonverbal methods is effective among novices, regardless of nationality. In particular, all nonverbal subgroups (Malaysian and Japanese students) scored higher than the verbal ones at WaH after the training. The immediate results show that the nonverbal training method is sufficient to develop the necessary risk recognition to train novices for risk activities compared with the verbal method, regardless of nationality. The results showed no significant differences among construction novices of different nationalities. Notably, video content must be customised for scenes or situations that have not received much attention in Malaysia. This method can assist construction novices and practitioners in achieving a better understanding of high-risk activities and relevant construction site safety knowledge. There is an urgent need for safety training for high-risk activities, such as WaH, for construction novices, especially Malaysian ones, to enhance their risk recognition ability.

Educators and policymakers should not overlook the importance of basic construction safety training. The experiment was conducted with construction novices who were undergraduate students of construction-related programmes. This study can be used as a reference by educators and policymakers in safety education programmes to design teaching methods for high-risk activities so that workers from different backgrounds, with or without field experience, can learn effectively. Further customised training content for high-risk activities, such as WaH, is necessary to suit the site safety culture in the Malaysian construction industry.

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