The Importance of Fire Safety Knowledge: A Case Study in a Malaysian city

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Abstract

In recent years, there were several incidents of fire in schools in Malaysia. Fire-related coincidences often result in injuries and sometimes death, which can be prevented through fire safety training. Fire safety education is essential to every student on campus. Fire safety knowledge learning and operational practice are both important. The aspect of fire safety awareness is proven inadequate. This study focused on the importance of Fire Safety Knowledge in proposing a fire safety awareness program in Malaysia. For this study, 30% out of the total number student and staff was selected as the sample population. The two main objectives of the study were to identifiy the level of fire safety knowledge of students and staff in regard to emergency response; and proposed a fire safety awareness training program.

Keywords: Fire Safety Knowledge, Malaysia, Emergency Response, Training

1 Introduction

As the nation progressed and transformed itself from an agrarian to an industrialized nation, disasters associated with development and technology become more apparent. Malaysia had encountered various types of disaster and of varying magnitudes. Besides the negative impacts of disasters to life and properties, they present rare windows of opportunity to learn from past mistakes, make improvements for the future (Drabek, 1995) and prepare to avoid future crises (Richardson, 1994). With the increased standards of living in the country, there is also less tolerance by the society to the accidents that involve multiple deaths and injuries, and major damage to properties and the environment. The challenge for the country is to be able to reduce the likelihood of disaster as the nation progress economically or minimize the impacts if it occurs.

Help! Fire! The sounds of those words evoke fear into the heart of anyone whose property or safety is threatened by the impending danger of fire. Society has come to rely on fire departments as its first line of defense in these situations (NVFC, 2004). Fire at Taufiqiah Khairiah Al Halimiah School on 22 September 1989. According to the investigation by the commission, the fire started at around two o'clock in the morning, at the lower level of Block E of the girls' hostel. The fire had destroyed eight hostel buildings, caused 27 deaths and six injuries to female students. Total lost was estimated to be around RM1.5 million. The fire and explosions at Bright Sparklers Sdn. Bhd. factory on 7 May 1991. On 7 May 1991, at approximately 3.45 p.m., a fire and several explosions erupted at the Bright Sparklers Sdn Bhd. fireworks factory at Kampong Baru, Sungai Buloh, and Selangor. Debris, stones, pieces of zinc roofs was hurled over a one kilometer radius. In the tragedy, 22 persons lost their lives while eight bodies pieces were unidentified and one person reported missing. In addition, 75 employees and 28 non-employees sustained injuries of varying degrees of seriousness. Over 500 residential homes and eight other factories nearby some of which were only about 10 to 15 meters away were damaged as a result of the fire and explosions. The fire and explosions at Port Kelang on 20 June 1992. Fire and explosion at Port Kelang was initiated by a fire on board a ship/tanker docking at the jetty of Tiram Kimia Sendirian Berhad (TKSB). The tanker, Choon Hong III was supposed to deliver 950 metric tons of toluene and 400 metric tons of xylene to consignees in Port Kelang. Because of the damaged starboard pump, the port pump and the same cargo line that was used to unload toluene was used to unload xylene. The areas that were affected by the fire were: parts of the TKSB jetty; the tank farm; storage area of drums of flammable materials of TKSB; the fire shed of TKSB where firefighting equipment was stored; some parts of TKSB's office and production area and part of Royal Yacht Club. It caused the deaths of 13 people (Aini and Fakhru'l-Razi, 2009).

Fire protection in schools and higher institutions should really begin at the very beginning i.e. during the conceptual planning stages of a particular project. Fire protection should not be considered as a mere facelift which may be superficially attached at the final stage or making the plant look more complete. Most planners would leave the fire protection task to engineering consultants and there is no doubt that these are the correct personnel to engage in design, construction and commissioning of physical fire protection facilities. Unfortunately, more often than not these personnel are not the first parties with whom planners make the initial contacts at the very earliest stage of a planned project.

According to the U.S. Census Bureau, more than 130,000 elementary and secondary schools, and about 4,200 higher-education institutions operate across the country. These learning centers educate an estimated 75 million children and adults each year. In Malaysia there are 9,922 elementary and secondary schools which educate an estimated 5,386,536 students (Ministry of Education Malaysia, 2010). From a numbers standpoint alone, it is obvious that providing adequate fire- and life-safety protection is critical to the well-being of a multitude of students. Unfortunately, what should be a combined effort to increase the level of fire protection in

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schools and universities often causes disagreement among facility managers, code writers and other building-industry professionals. Statistics show that elementary and secondary schools are in session 70 percent of the time a fire starts, according to the National Association of State Fire Marshals. Colleges and universities have a constant change of students entering campus buildings to study for extended lengths and accommodate large numbers of students in residence halls. These factors make it critical for education facilities to protect against fires for long distance of time if students are not able to quickly exit the building. (Razwick, 2010). Below is some statistics obtained from Fire and Rescue Department Malaysia.
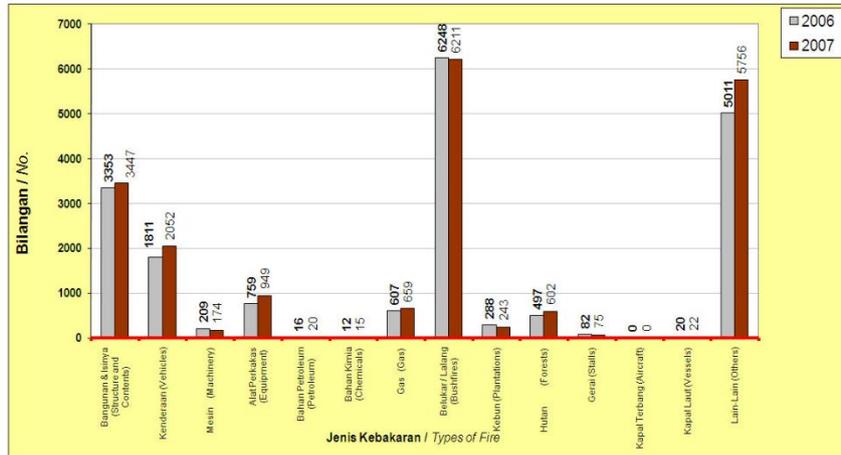

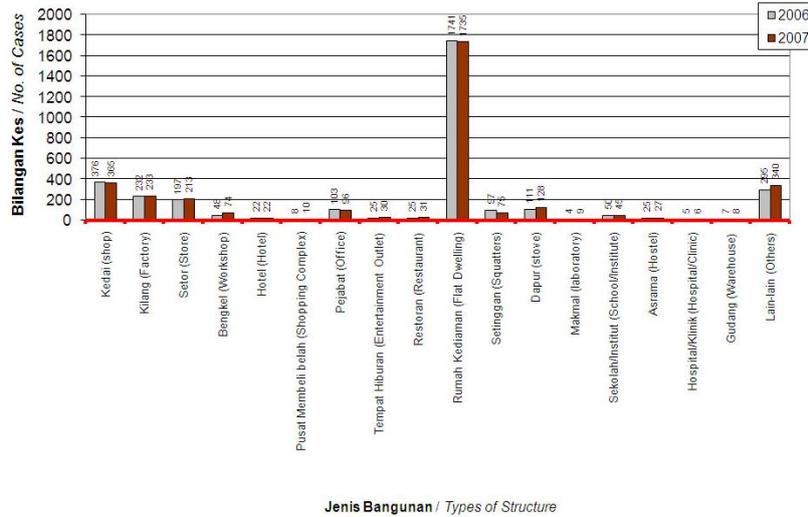Figure 1: Fire Figures According to Fire Types for the Year 2006 and 2007

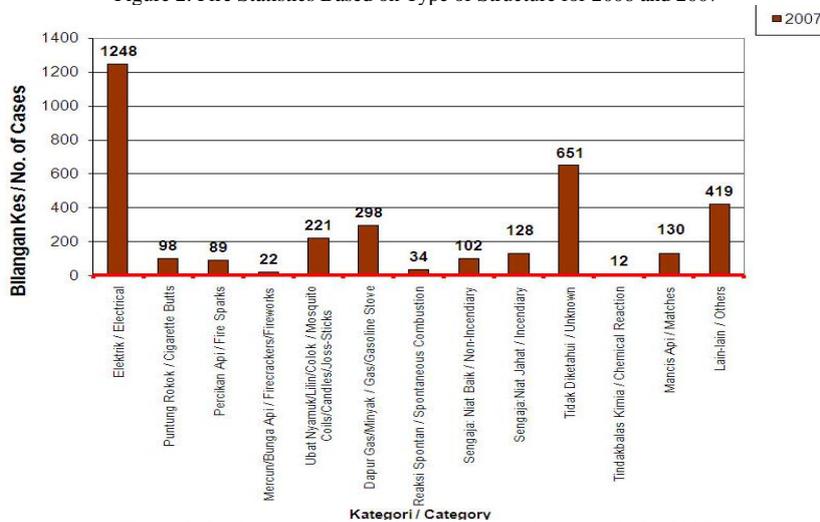Figure 2: Fire Statistics Based on Type of Structure for 2006 and 2007

Figure 3: Statistics on Causes of Building Fires in Malaysia for 2007

One key reason students may not immediately exit a school facility during a fire is failure to recognize or respond to fire alarms. According to a study by the Institute for Research in Construction (IRC), 45 percent of building occupants are not able to distinguish fire alarms from other types of alarm systems because of a lack of consistent alarm patterning. The IRC also states that occupants exposed to more than three false alarms per year typically do not regard any additional alarms as a serious indicator of danger. This is a concern for students subjected to frequent fire alarm drills or false alarms - as often occur in residence halls, where pranks are common. Fire-rated materials can contain flames and smoke until students recognize a fire and safely exit the building. Hysteria also can hold elementary and secondary students inside buildings during fires. Students may panic and not be aware of the most appropriate exits; in other cases, too many students rush toward the same exit. As a result, students may be bottlenecked in stairwells and corridors. Fire-rated stairwells and corridors can help block fires from entering those critical areas and provide ample time to vacate the building. In height of this understanding and possible danger, this research was conducted to avoid, mitigate or lessen and be prepared in any fire eventuality by igniting fire safety knowledge deriving from the findings gathered amongst the staffs and students of PPKS-Miri.

Pusat Pembangunan Kemahiran Sarawak (PPKS) or Sarawak Skills Development Centre (SSDC) was established in June 1994 under the Societies Act 1966 with the objective of producing well-trained, skillful and competent workforce by offering training programs which are practical and skills-based, and technical competence in all professional areas. Pusat Pembangunan Kemahiran Sarawak (Sarawak Skills Development Centre) branch office at Lutong, Miri was launched on 29 May 2007.PPKS is led by the industrial sector with the support of both the Federal and State governments. The State Government will provide the necessary infrastructure and annual grant (operational costs) for the Centre while the Federal Government will finance the purchase of training equipment (submission on annual basis). The industrial sector will be taking the leading role in managing and determining the direction of the centre, i.e. industrial driven through its representatives in the Management Council. As an emerging organization, PPKS-Miri is still in the process of improving its occupational safety and health management system as the current system only covers the basic knowledge on how to use fire extinguisher. Currently there are only some posters strategically placed around campus which is provided by Fire and Rescue Department Malaysia. A sample of the poster is available on the next page.
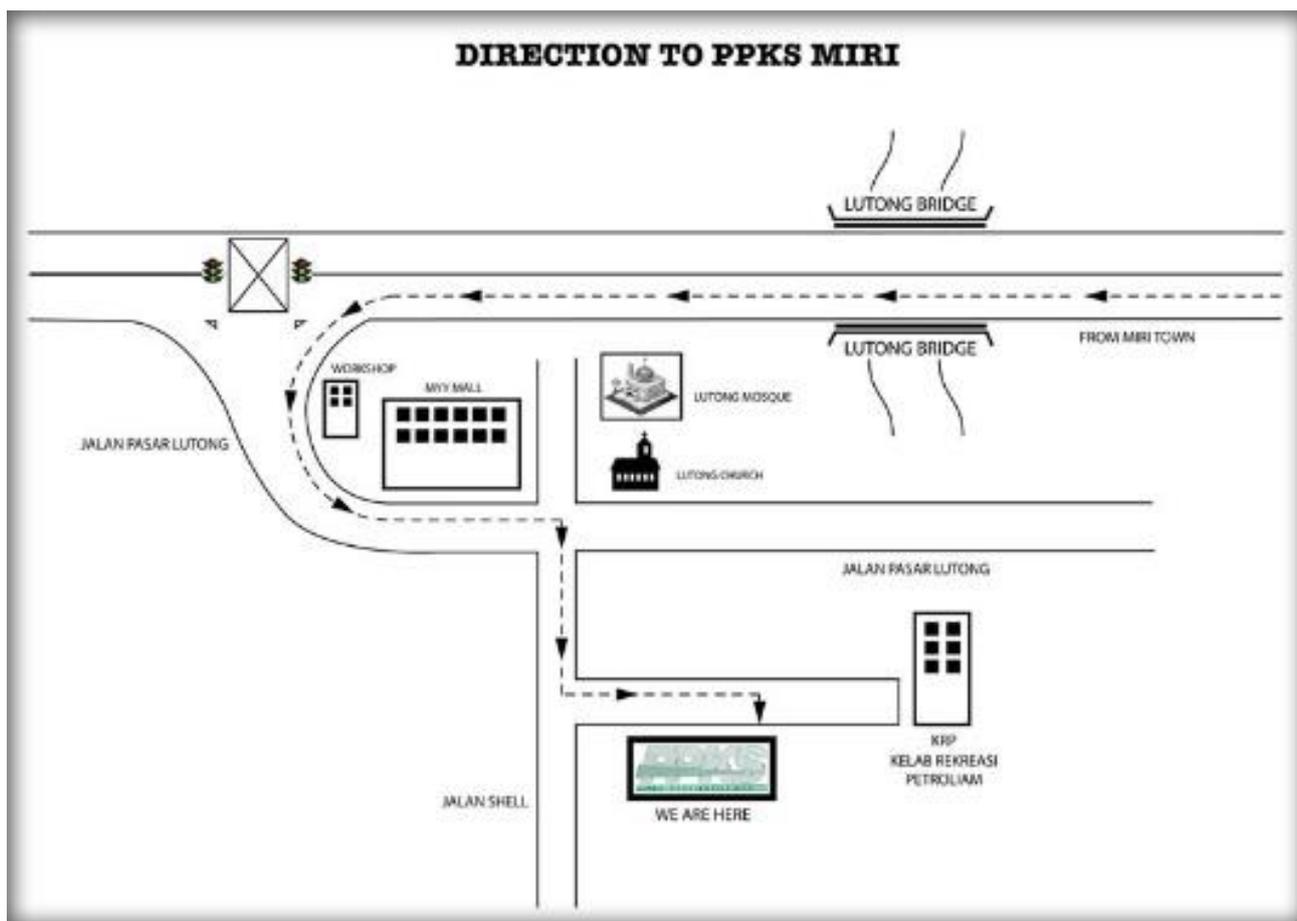

Figure 4: Locality Map of PPKS

2 Conceptual Framework

The conceptual framework as shown below reflects the identification of the level of fire safety awareness and proposing a suitable fire safety awareness program. Thus, related training and drills are crucial elements in emergency mitigation, preparedness, response and recovery.

Figure 5: Conceptual Framework

Data collected and compiled during the Questionnaire Survey will be analysed statistically to find out whether the level of fire safety awareness is significantly minimal and below average.

3 Results and Discussion

Table 1 as indicated below, Pusat Pembangunan Kemahiran Sarawak (PPKS) vision and mission of providing training, advocacy, sponsorship and scholarship that is industry-based and in line with the national aspiration. Its main target group is youth and has been in operation for 5 years. PPKS board comprises of non-professional with 24 staffs and an annual budget of RM61,000 which mainly comes from non-government agencies. PPKS is locally accredited and has affiliations with the civic sector. As far as fire safety is concern, PPKS has an annual budget of less than RM10, 000. The main programs are mainly safety drills and facility improvement. Basically, PPKS obtained the related license on fire and building permit.

Table 1 indicated that PPKS is mainly a vocational training provider that exists for five years and catering for the youth of Sarawak by providing an industry-based technical/vocational training. Alongside with this, PPKS also provide scholarship and advocacy. Mainly PPKS accreditation and linkages are with local institution and civic sector. PPKS is being manned by 44 staff with the able support of non-professional board of trustees. PPKS operates on a limited annual budget of RM61, 000 which comes from non-government sectors. Consequently, this also reflects the minimal budget allocation in fire safety program of less than RM10, 000 per annum. With such budget, PPKS main fire safety activity evolves in drills and facility improvement. As a training institution obtained the basic fire and building permit.

Table 4 signified that the almost (90%) all the respondents of this research proposal are early adulthood within the age range of 18-25. Predominantly, the level of understanding and appreciation will center on the nature and nurture of said age sector on matters of fire safety. Thus, the research findings may vary from one age bracket to another. This also reflects the main target group of PPKS, which is youth. Public education campaigns aimed at adults to increase their hazard awareness and preparedness are often evaluated (e.g. Anderson-Berry et al., 2003; Turner et al., 1986; Faupel et al., 1992; Lopes, 1992), however, the effectiveness of school-based hazard education programs is infrequently reported (Ronan and Johnston, 2001, 2003). As hazards do not necessarily occur when families are together at home, it is as important for youth to be aware of and prepared for hazards as it is for adults, so that they can respond and cope effectively to an emergency situation. Having both adults and youth educated in, and undertaking hazard preparedness measures promotes overall personal, family and community resilience. Table 4.2 also signified that 100% of the respondents have working experience: 71% work with private companies and (29%) working with other types of companies.

Table: 1 Profile of the Organization

Name of the Organization	o	Pusat Pembangunan Kemahiran Sarawak
Vision, Mission & Goal	o	**Vision** – " To become the preferred Hands-on Technical Training and Education Provider in the Region
	o	**Mission** – "To meet the existing and emerging needs for competent and professional people to support industrial development in the region by providing quality technical training and education in line with the national aspiration. We will achieve this by being accountable, innovative and responsive to our stakeholder' expectation"
Basic Program Thrust	o	Education/Sponsorship
	o	Training/Advocacy
Years of Existence	o	5 years
Target Group	o	Youth
Board Composition	o	Non-Professional
Number of Staff	o	24
Annual Budget	o	RM61,000
Major Source of Fund	o	Non-Government
Types of Accreditation	o	Local
Existing Linkages	o	Civic Sector (NGOs/POs)
Budget Allocation for Fire Safety Program	o	Less than RM10,000/annum
Fire Safety Program	o	Drills
	o	Facility Improvement
Related Fire Safety Permit & License	o	Fire Permit
	o	Building Permit

The respondents have a varying degree of experience of the actual workplace hazards. This will significantly increase the relevance and credibility of the research findings as it relates to a real life work-experience scenario. Workplace accidents have generally been attributed to engineering aspects of safety (Vredenburgh, 2002). The major causes of workplace injuries are poor usage and handling of tools and machinery. In line with the technology improvement and increased efforts on engineering safety, safety at the workplace progressively improved. Nonetheless, technological system's failure still do account for workplace accidents, albeit at a reduced rate. According to Vredenburgh (2002) technological system's failure now accounts for only 10 percent of accidents. In managing the interaction between system and people the importance is placed on effective safety management. Herbert W. Heinrich, an early pioneer of accident prevention and industrial safety noted that 88 percent of industrial accidents originate from human factors (Goetsch, 2010). Since human factors play a significant role in the safety performance (Donald and Young, 1996), greater attention is now being directed on examining the behavioral causes to technological failures, which is now widely called "human error". Many researchers now recognize the importance of a strong safety culture in ensuring both the organization and employee achieve a high standard of safety in the workplace (Beckmerhagen et al., 2003). Thus, a proper understanding of the individual who function independently or within groups operating in a technological system is increasingly becoming important in understanding work-related accidents. Beliefs and attitudes of the people working within the organization greatly affect the safety in the workplace. Safety culture is a concept that arose as a result of the Chernobyl nuclear accident in the then Soviet Union in 1986. According to Vredenburgh (2002) as a result of the accident, there was a greater focus on the human and organizational elements that contribute to unsafe operation of technological systems.

Figure 6 shows the mean and also the standard error for each of the level of knowledge for all for all the 15 fire safety related knowledge. The mean number of respondents with no knowledge at all is 35 with a standard error of 5.11. As for having little knowledge on fire safety the mean score is 27.93 and a standard error of 2.31. The mean value of people with average knowledge is 32.20 and has a standard error of 2.44. Respondents with very good knowledge had a mean of 17.73 and a standard error of 2.58. Lastly those with excellent knowledge only had a mean value of 7.13 and a standard error of 1.1. From the figure above it can be concluded that respondents with no knowledge at all and excellent knowledge has high significant difference because the error bars of both does not overlap. Aside from that the error bar for respondents with excellent knowledge is the narrowest, thus it shows that all the data obtained has an only a small error and reliable.

Figure 7 shows that seventy-five percent (75%) of the respondents have no knowledge on Fire Services Act 1998; seven point five percent (7.5%) Little knowledge; fourteen point two percent (14.2 %) Average knowledge; two point five percent (2.5%) Very Good knowledge; and (0.8%) with Excellent knowledge. Figure 3 indicated 83% has no substantial knowledge on Fire Services Act 1998: 75% None at all and 8% -Little knowledge. This may imply that this 83% of respondents are unmindful if business establishments comply with the legal requirement on fire safety or not. In the end, this can result into a risk by endangering them to come and visit

those kinds of organizations from time to time without complaining about building fire safety.

Table 4: Summary of Staff & Students Basic Profile

| Contents	Variable	Frequency	Percent (%)
Age	18-25	108	90
	26-33	12	10
	34-41	0	0
	42-Above	0	0
	Total	120	100
Gender	Male	66	55
	Female	54	45
	Total	120	100
Civil Status	Single	110	91.7
	Married	9	7.5
	Widow	1	0.8
	Other	0	0
	Total	120	100
Religion	Muslim	54	45
	Christian	56	46.7
	Buddha	10	8.3
	Total	120	100
Educational Background	SPM/STPM	89	74.2
	Diploma	20	16.7
	Degree	11	9.2
	Graduate	0	0
	Post Graduate	0	0
	Other	0	0
	Total	120	100
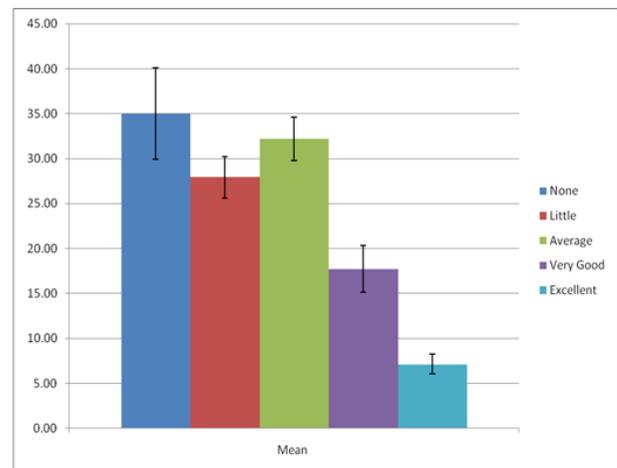
Figure 6: Mean and Standard Error

This kind of apparent complacency may contribute to serious incident in any fire eventuality. From the statistical analysis it is proven that the fire safety knowledge of the respondents is significantly low. This increases the potential of fire casualties and even fatalities. The 65% maybe subjected for fire rescue. Public education campaigns aimed at adults to increase their hazard awareness and preparedness are often evaluated (e.g. Anderson-Berry et al., 2003), however, the effectiveness of school-based hazard education programs is infrequently reported (Finnis et al., 2004).

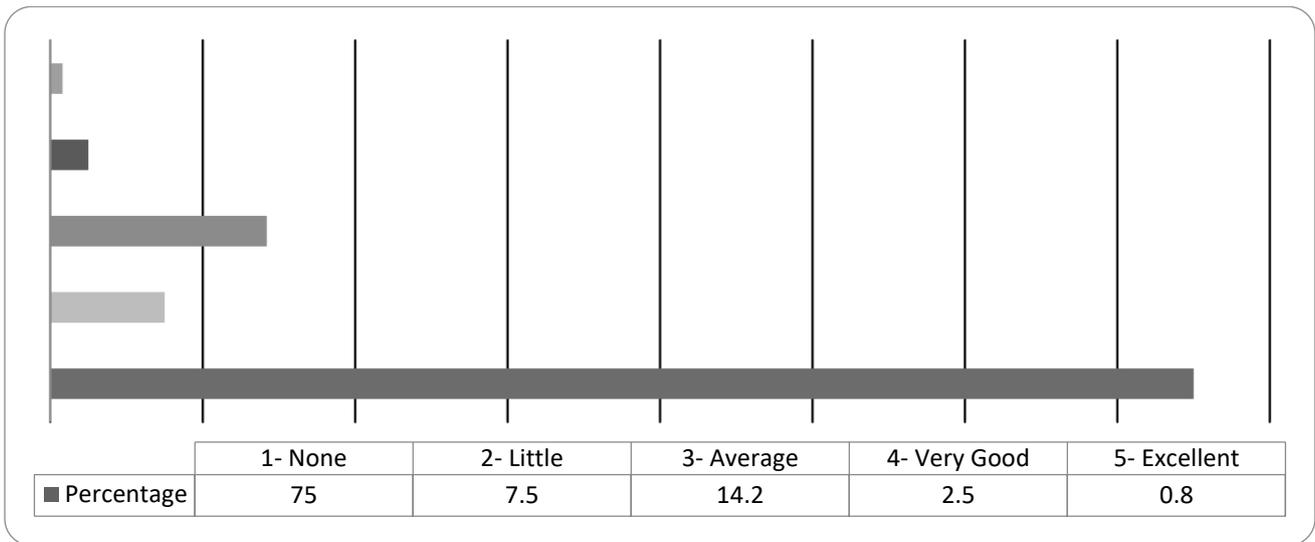|	1- None	2- Little	3- Average	4- Very Good	5- Excellent
■ Percentage	75	7.5	14.2	2.5	0.8

Figure 7: Basic Fire Safety Knowledge On: Fire Services Act 1998

As hazards, do not necessarily occur when families are together at home, it is as important for youth to be aware of and prepared for hazards as it is for adults, so that they can respond and cope effectively to an emergency situation. Having both adults and youth educated in, and undertaking hazard preparedness measures promotes overall personal, family and community resilience. Figure 8 shows that thirty-five point eight percent (35.8%) of the respondents have No Knowledge on PPKS Fire Safety Plans; twenty nine point two percent (29.2%) Little knowledge; twenty-three point two percent (23.2 %) Average knowledge; ten point eight percent (10.8%) Very Good knowledge; and zero point eight percent (0.8%) with excellent knowledge.

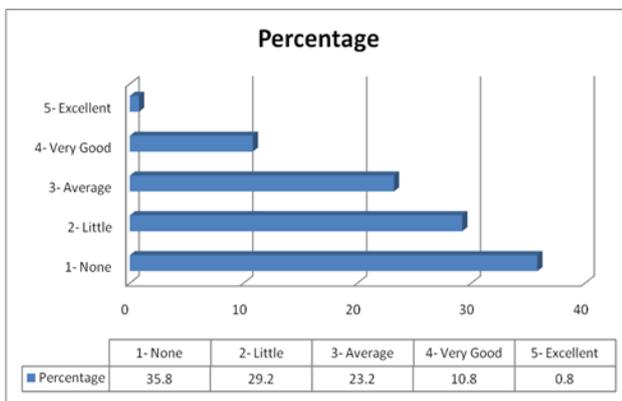|	1- None	2- Little	3- Average	4- Very Good	5- Excellent
■ Percentage	35.8	29.2	23.2	10.8	0.8

Figure 8: Basic Fire Safety Knowledge On: PPKS Fire Safety Plans

Table 1 indicated that PPKS is mainly a vocational training provider that exists for five years and catering for the youth of Sarawak by providing an industry-based technical/vocational training. Alongside with this, PPKS also provide scholarship and advocacy. Mainly PPKS accreditation and linkages are with local institution and civic sector. PPKS is being manned by 44 staff with the able support of non-professional board of trustees. PPKS operates on a limited annual budget of RM61, 000 which comes from non-government sectors. Therefore, this also reflects the minimal budget allocation in fire safety program of less than RM10, 000 per annum. With such budget,

PPKS main fire safety activity evolves in drills and facility improvement. As a training institution obtained the basic fire and building permit.

Figure 3 indicated 83% has no substantial knowledge on Fire Services Act 1998: 75% None at all and 8% -Little knowledge. This may imply that this 83% of respondents are unmindful if business establishments comply with the legal requirement on fire safety or not. In the end, this can result into a risk by endangering them to come and visit those kinds of organizations from time to time without complaining about building fire safety. This kind of apparent complacency may contribute to serious incident in any fire eventuality. From the statistical analysis it is proven that the fire safety knowledge of the respondents is significantly low. This increases the potential of fire casualties and even fatalities. The 65% maybe subjected for fire rescue. Public education campaigns aimed at adults to increase their hazard awareness and preparedness are often evaluated (e.g. Anderson-Berry et al., 2003).

Conclusion

The study analysed the importance of Fire Safety Knowledge in Proposing a Fire Safety Awareness Training program to PPKS in Miri Malaysia. PPKS is mainly a vocational training provider that exists for five years and catering for the youth of Sarawak by providing an industry-based technical/vocational training. Alongside with this, PPKS also provide scholarship and advocacy. Mainly PPKS accreditation and linkages are with local institution and civic sector. PPKS is being manned by 24 staff with the able support of non-professional board of trustees. PPKS operates on a limited annual budget of RM61, 000, which comes from non-government sectors. Consequently, this also reflect the minimal budget allocation in fire safety program of less than RM10, 000 per annum. With such budget, PPKS main fire safety activity evolves in drills and facility improvement. As a training institution obtained the basic fire and building permit. As a new and low-budget organization, PPKS is limited into fire safety drills and facility improvement as far as safety training is concern. Basically, PPKS complied with the legal requirements of fire and building permit. On the other hand, the aspects of fire safety drills are proven inadequate. The method of the selection of the respondents is uneven and not fairly chosen. A more homogenous nature of the respondent can

increase the credibility of the research findings and a more faithful generalization of the conclusions: There was an evident need of more intensive and intentional fire safety awareness training program in PPKS. The training needs for fire safety knowledge can be categorized into a level of training priority.

Ethical issue

Authors are aware of, and comply with, best practice in publication ethics specifically with regard to authorship (avoidance of guest authorship), dual submission, manipulation of figures, competing interests and compliance with policies on research ethics. Authors adhere to publication requirements that submitted work is original and has not been published elsewhere in any language.

Competing interests

The authors declare that there is no conflict of interest that would prejudice the impartiality of this scientific work.

Authors' contribution

All authors of this study have a complete contribution for data collection, data analyses and manuscript writing.

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