

An Investigation of Safety Training and Safety Outcome in a Manufacturing Plant

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Article history

Received :20 February 2013

Received in revised form :

16 July 2013

Accepted :15 August 2013

Abstract

Safety training is considered as one of safety intervention that is believed to be an antecedent of safety outcome within organization. The rapid advancement in safety management field has also raised many questions mainly to the roles of safety training in organizations safety. Nevertheless, to date far too little discussions have been made to empirically study the impact of safety training and its influence to safety outcome in the workplace. Therefore, the purpose of this longitudinal study is two-fold, first it attempts to examine the level of safety training impacts over time, and secondly it seeks to examine the relationship between safety training and safety outcome (workplace accidents) over time. Quantitative approach using longitudinal design is employed for the purpose of data collection. The results were based on two data collection carried out in one of Malaysian manufacturing plant in 2008 and 2009. The response rate was 83% (N=330) in 2008 and 98% (N=402) in 2009. Overall, the current study has gone some way towards enhancing our understanding of safety training impacts particularly with regard to the improvement of safety outcome. However, this study has thrown up a number of questions in need to further investigation. The need for further research to evaluate the effectiveness of a specific training intervention in reducing particular types of injury and its relation to safety culture over time in various industries is prevailing to be crucial.

Keywords: Safety training; safety knowledge; safety outcome; safety behavior; safe work practices

Abstrak

Latihan keselamatan merupakan satu intervensi keselamatan yang dipercayai menjadi antecedents terhadap hasil keselamatan di dalam organisasi. Perkembangan yang pesat dalam bidang keselamatan telah menimbulkan banyak persoalan tentang peranan latihan keselamatan di dalam organisasi. Walau bagaimanapun, sehingga kini agak sedikit perbincangan secara empirikal dijalankan untuk melihat pengaruh latihan keselamatan terhadap hasil keselamatan di tempat kerja. Oleh yang demikian, terdapat dua tujuan kajian longitudinal ini dijalankan, pertama untuk mengenalpasti tahap kesan latihan keselamatan dalam tempoh dua masa (tahun pertama dan tahun kedua), kedua untuk menentukan hubungan antara latihan keselamatan dan hasil keselamatan (kemalangan di tempat kerja) dalam tempoh dua masa (tahun pertama dan tahun kedua). Pendekatan kuantitatif menggunakan rekabentuk longitudinal digunakan untuk tujuan pengumpulan data. Dapatan kajian adalah berdasarkan kepada dua fasa pengumpulan data yang dijalankan di sebuah kilang di Malaysia pada tahun 2008 dan 2009. Kadar pulangan borang soal selidik adalah 83% (N=330) pada tahun 2008 and 98% (N=402) pada tahun 2009. Secara keseluruhannya, kajian ini telah meningkatkan pemahaman terhadap latihan keselamatan terutamanya berkaitan dengan peningkatan kesan latihan keselamatan dan hasil keselamatan. Walau bagaimanapun, kajian ini telah menimbulkan beberapa persoalan untuk kajian akan datang. Terdapat keperluan untuk menyelidik dengan lebih mendalam keberkesanan intervensi latihan keselamatan tertentu dalam mengurangkan kecederaan tertentu dan hubungannya dengan budaya keselamatan di beberapa industry amatlah kritikal.

Kata kunci: Latihan keselamatan; pengetahuan keselamatan; hasil keselamatan; tingkah laku selamat, amalan kerja selamat

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1.0 BACKGROUND

1.1 Safety Training

Safety training has been viewed as part of human resource intervention in an attempt to improve positive safety outcomes (for example; accident, incident and near miss) at workplace. The importance attached to safety training is highlighted by national regulatory systems for employers to provide appropriate safety training during initial hiring and on specific safety training to employees (Cohen & Colligan, 1998; Oberman, 1996). Every country all over the world has their own regulatory systems that require all employers to follow, for example in the UK, Health and Safety at Workplace (HASAWA) 1974, in the US, Occupational Safety and Health (OSHA) 1970 and in Malaysia, Occupational Safety and Health (OSHA) 1994. Therefore, it is an obligation for all employers to provide safety training to all employees in their organization. Smith & Mustard (2007) reported that in Canada, employers have to possibly prevent injury by providing information to employees on workplace hazards and dangers. As stated under a system “internal responsibility” it is a mandatory requirement for employer to instruct employee on how to use machinery and safety equipment properly.

1.2 Safety Training Impacts

It has been widely argued that training at workplace offers clear benefits for individual and organization safety (Aguinis & Kraiger, 2009). Numerous studies revealed that safety training giving an impact to the significant improvement in safety knowledge, attitudes and behavior (Lingard, 2002; Sinclair *et al.*, 2003; Goetch, 2005; Jensen, 2005; Burke *et al.*, 2006). Employee who received appropriate safety and health training is expected to enhance their safety knowledge, safety attitude, safety behaviour as well as performed work activities in a safely manner (Goetch, 2005; Jensen, 2005). Cohen & Colligan (1998) reviewed the literature on safety training that drawn from the period 1980 through 1996 and found the evidence that safety training has been used as an intervention to enhance worker knowledge of workplace hazards, effect on behaviour changes, compliance to safer work practices and other action that aimed to reduce injuries, illness and diseases. There were 80 reports analysed and results found that training give significant impacts in increasing workers knowledge and effect on safer work practices (Cohen & Colligan, 1998). Safety training is also argued very importance and significance as it helps workers to understand standard operating procedures, potential hazards, judgment of risk as well as a risk control method (for example, Zohar, 1980; Cooper, 1998; Harvey *et al.*, 2001; Lingard, 2002; Tophoj, 2005; Jensen, 2005). A growing body of literature pertaining positive safety training impacts has revealed that safety training result in significant positive changes in many aspects. It is difficult to ignore the importance and significance of safety training within organizations especially the assessment part as it will identify the effectiveness or the return on investment of training programs. As asserted by Burke *et al.* (2006) in their meta-analysis that most safety training intervention lead to positive effects on safety knowledge, adoption of safe work behaviours and practices, and safety outcome (e.g; accident rate). Therefore, safety training impacts for this study context will be asses on transfer and retention of safety knowledge and skills, safe behaviour, safe work practices and safety attitude as a result of safety training that has been attended by employees.

The first safety training impact is transfer and retention of safety knowledge and skills. Knowledge is considered as one of

the category of learning outcomes. The most commonly accepted definition of knowledge includes the facts that people learn and the approach how to use the facts they all cognitive in nature (Blanchard & Thacker, 2003). As claim by Kraiger and his colleagues, the knowledge category of learning refers to these elements: The information we acquire and place into memory; How information is organized for use into what we already know; and our understanding of how, when, and why information is used and is useful (Kraiger, Ford & Salas, 1993). Through training one can possibly apply previously learned knowledge to the solving of practical problems (Anderson, 1987) and safety knowledge is acquire mainly from safety training (Burke *et al.*, 2002). Employees, whose knowledge acquisition and retention are high, are expected to better prepared and able to transfer training compared to those whose knowledge acquisition is low during the training program (Elangovan & Karakowsky, 1999). Therefore, trainees have to obtain the relevant knowledge and skills before it can be generalized and maintain in the job context. A number of study (e.g. Griffin & Neal, 2000; Burke *et al.*, 2002; Sinclair *et al.*, 2003; Cheung & Spickett, 2007) revealed empirical support the relationship among amount of safety training, perceived safety knowledge, and self and supervisor ratings of safety performance. For example, a research reported that safety knowledge, with respect to specific dimensions of safety performance (i.e. Using Personal Protective Equipment, Engaging in Work Practices to Reduce Risk, and Communicating Health and Safety Information), was positively related to safety performance on each performance dimension, correspondingly (Burke *et al.* 2002). Another study found that was a significant increase in safety knowledge after the training course among undergraduate students in a science stream at a Hong Kong university (Cheung & Spiket, 2007). In this study, safety knowledge and skill is operationalized as transfer and retention of safety knowledge and skills that employees acquired as a result of safety training that has been attended by them.

The second safety training impact is relates to safety behavior. Glendon and his colleagues draw our attention that there are some theoretical perspectives toward attitude and behavior (Glendon, Clarke & McKenna, 2006). The theoretical underlying attitudes and behavior are: Attitudes influenced behavior; Behavior influences attitudes; Attitude and behavior are mutually reinforcing and Attitudes and behavior are likely to be mutually consistent, but independent (Glendon *et al.* (2006, p195). Attitude-behavior link is complicated due to variability of people. A study by Mukherjee *et al.*, (2000), revealed that workers and managers who participated in training increased their personal safety and health behavior. Both of the groups contributed to emergency preparedness, and both influenced the elimination of hazardous chemicals. Moreover, Cooper and Phillips (2004) explain that employees’ perception to the importance of the training is significant to predict the actual level of safety behavior. Most of them conceptualized safety behavior as changes on action and behavior on safety related matters. Safety behavior in this study is operationalized as employees’ perceptions on their own safety behavior as a result of safety training that has been attended by them.

The third safety training impact is relates to safe work practices. Safe work practices refer to the specific way or practices in which work is performed safely such as following safety procedures of particular job or task, slower line speed, better work/rest scheduling, monitoring work areas and invoking operating procedures and job enlargement (Goldenhar, Moran & Colligan, 2001). According to International Labor Organization (2007), unsafe work practices continuing to happen in many organizations and caused in work related injuries, occupational diseases, and fatalities. Numerous studies have attempted to

explain the effect of safety training on safe work practices (for example, Lippin *et al.*, 2000; Materna *et al.*, 2002; Lingard, 2002; Burke *et al.*, 2002; Harrington and Walker, 2004). Lippin *et al.*, (2000) study's found that respondents from four sectors reported changes by following a safer work practices. Their study revealed 62.3% of respondents reported that they follow established safety procedures more since the training. Materna *et al.*, (2002) evaluated an educational intervention to improve self-reported lead safety practices among 21 painting contractors and their employees. Analyzing the results of pre-and post-intervention employer focus groups, the authors found only modest improvements in reported lead safety practices, with 15 of 27 employers and three of 12 employees meeting target work practices objectives. Lingard (2002) assessed the effects of first aid training on observed safety practice among 22 employees of small construction companies in Australia. Before-and-after measurement performance showed significant improvement in use of personal protective equipment, but only moderate improvement in use of tools and no significant change in two other individual safety performance categories. Therefore, safe work practice in this study is operationalized as employees' action on performing safe work to ensure safety and minimize risk, hazard and danger in their job context. Employees reported on their safe work practices based on a series of questions related to safe work practices.

The fourth safety training impact is relates to changes on employees safety attitude as a consequences of safety training. Oskamp (1977) views attitude has three components. The first component is a cognitive components that consist of the ideas and beliefs which attitude holder has about the attitude object; the second component relate attitude as an affective (emotional) component that refers to the feelings and emotions one has toward the object; and the third component is a behavioral component that consist of one's action tendencies towards the objects. It can be inferred that attitude mainly associated to what people think, feel and do in relation to a particular object (i.e, safety training). Previous studies (for example, Lippin *et al.*, 2000; Harrington & Walker, 2004; Cheung & Spicket, 2007) have reported that safety training having an impact on safety attitude. Training has changed managers' attitudes towards safety and reduces the workplace hazards (Lippin, *et al.* 2000). Harrington and Walker (2004) demonstrated that participants who completed the training significantly improved their score on knowledge, attitude and practices. The treatment group significantly increased overall scores between pre- and post-test, and also for scores on each subtest (knowledge, attitudes, practice). Another study conducted by Cheung & Spicket (2007) also found that there was a significant improvement in positive safety attitude as well as a decrease in negative safety attitude among the students. Safety attitude in this study context is operationalized as employees' belief and feel towards safety training that has been attended by them. Employees reported on what they feel and belief on safety training based on a series of questions related to safety attitude. Therefore the first objective of this study is to examine employees' judgment on safety training impacts over a period of time.

1.3 Safety Training and Safety Outcomes

Workplace accidents and injuries can be avoided or prevented. One way of preventing workplace accidents or injuries is via safety training. It is believed that safety training could help to reduce accidents, injuries, compensation costs and raising employees' safety awareness at workplace (Gillings & Kleiner, 1993; Marsh *et al.*, 1995). Workplace accidents and injuries place an enormous social and financial burden on workers and their

families, the industry and the public (Dong *et al.*, 2004). Through safety training, employees is expected to possess an adequate knowledge, skill and promote safety in effective way (Fender, 2002; Yu & Hunt, 2004) as the ultimate goal of workplace safety training is injury prevention and control (Johnston *et al.*, 1994). Several studies have revealed that safety training has been negatively associated with workplace accidents and injuries (Kinn *et al.*, 2000; Kaminski, 2001; Dong, 2004; Johnston & Rupee, 2002; Zierold & Anderson, 2006). Kinn *et al.*, (2000) investigated the injury prevention effect of safety orientation and training among plumbers and pipe fitters in north western Ohio. They match the training records for six employers with the Occupational Safety and Health Administration's "recordable" injury data for 1996 to 1998. Kinn *et al.*, (2000) found that employee safety orientations were significantly associated with a reduction in injuries. This findings similar to Dong *et al.*, (2002) study, who reported that laborers who received safety and health training during the study period were 12% less likely than non-trained laborers to file for workers associated with a 42% reduction in claims. These findings provide evidence of the effectiveness of safety training in preventing occupational injuries among construction laborers, particularly among younger workers. In his study on small manufacturing firm in the US, Kaminiski (2001) found that training (including safety training) was negatively associated with the injury rate. His finding proved the notion that safety training giving benefits for both managers and employees and hence the training investment compensate. Safety training is expected to increase workers knowledge about safety issue and access to resources about safety.

In a study involving construction company in Hawaii, Johnson & Ruppe (2002) reported a reduction in injury and lost workdays linked with comprehensive toolbox training session. Finding demonstrate a reduction in reported injuries, lost workdays, observed safety hazards, and levels of perceived stress for a majority of workers during each of the two years after implementation of the weekly training session. Zierold & Anderson (2006) study that employed descriptive analysis and chi-square analysis demonstrated that more than half of respondents agreed that safety training helps to prevent injuries and near misses incidents at workplace. Although a number of studies revealed that safety training had been associated with workplace accidents and injuries, it has been argued that there are relatively few examples of studies that have quantified injury reductions after training (Johnston, Cattledge & Collins, 1994; Sulzer-Azaroff & Austin, 2000). This argument is in line with previously mentions that many organizations do not quantitatively assess or evaluate safety training impacts including reduction of workplace accidents or injuries. Moreover, in their review of safety training research conducted in the US, Colligan & Cohen (2004) argue that relationships between safety training impacts and actual reductions in injuries were not clearly shown although there were showing evident success in meeting their objectives. Owing to the overall support in the literature it is believed that acquired safety knowledge and skills to the job contexts, changes in safe work practices, safety behavior and safety attitude that make it unlikely for employees to have accidents or injuries. Therefore the second objective of this study is to examine the relationship between safety training and safety outcomes (workplace accidents) over a period of time.

2.0 METHODOLOGY

2.1 Population and sample

The participating organization in this present study is one of Malaysian based electric and electronic manufacturing plant. The electric and electronic industry is Malaysia's leading industrial sector, contributing significantly to the country's manufacturing output, exports and employment (MITI, 2008). This manufacturing plant located at the south of Peninsular Malaysia and the main productions of this company are cooper wire and power cord that has been produce by the different department (i.e., EW and FFC). The target population of this study was all production workers in this manufacturing plant who involved in operations and production of the company product. The selection of the target population was based on the fact that all of employees had received safety training and also this target group have a variety of hazards and accidents common to many other workplaces such as strain/sprain, slip/trip, Cut/pinch, fall, respiratory hazards, fire/explosion, and serious injuries or fatalities due to improper lockout/tagout. The researcher has gained access to conduct her study in one of Malaysian manufacturing company through a series of discussions with human resource manager, safety manager and training officer of the participating company.

The questionnaire for assessing safety training impacts was developed by the researcher based on extensive literature review and company documents, a number of items that make up particular scales has been developed to ensure content validity of the instruments.

Four scales has been delineated to measure safety training impacts has been decided, namely; Safety knowledge and skill transfer, safe behaviour, safe work practices and safety attitude change. A total of 31 items were initially generated from a variety of sources. As suggested by Dillman (2000), both positively and negatively worded items were included. Double barrelled items, lengthy items, items with difficult vocabulary or multiple negatives, and ambiguous pronoun references were avoided (DeVellis, 2003). The *safety knowledge and skill transfer* scale intend to measure transfer and retention of safety knowledge and skills that show their understanding on safety. This scale consist of nine items asks participants to rate the extent to which they agree with statements about the transfer and retention of knowledge in their job. Six items has been adapted from HSE (2000) and three items has been developed by researchers based on literature review. Although the six items that has been adapted from HSE (2000) that was originally to items in safety culture maturity model, however the six items related to training and competence seems to be appropriate and suitable to measure knowledge and skill transfer scale. The *safe work behaviour* scale seeks to measure employees' perceptions towards their own safety behaviour especially on safe or unsafe action that has been carried out by them as a result of safety training. This scale be made up of seven items asks participants to rate the extent to which they agree with statements about their own behaviour with regards to perform work in a safety manner and reduce or minimise accidents or injuries. Two items has been adapted from Burke *et al.*, (2002), two items has been adapted from Mukherjee *et al.*, (2002) and the other three items has been adapted from Rundmo (1994) safety behaviour scale. Two items from Rundmo (1994) has been changed from positive to negative wording (i.e., "I take shortcuts that involve little or no risk" was originally "I didn't take shortcuts that involve little or no risk"; "I carried out work activities that are forbidden" was originally "I didn't carried out work activities that are forbidden"). One item of Rundmo (1994) has also been change the wording (i.e., "I follow safety

regulations to get the job done", originally the word follow is "ignore"). The *safe work practices* intends to measure employees action on performing safe work to ensure safety and minimise risk, hazard and danger in their job context. This scale comprise of eight items asks participants to rate the extent to which they agree with statements about their safe work practices on performing their job safely. Six items has been adapted from Burke *et al.*, (2002) and two items has been developed by researchers based on literature review and company document. The *safety attitude change* scale intends to measure employees' belief and feel towards safety as a result of safety training that has been attended by them. Seven items scale has been developed from various literature review pertaining attitude changes as a result of safety training. The ideas of wording/statement of the items mainly from the literature and the company document then it has been modified by the researchers to make suit to the purpose of asking participant's agreement on attitude changes as a result of training. The *safety outcomes* question intends to measure the workplace accident history of the participants. One item "have you ever had a work-related accidents or injury in the last 12 months?" was used to measure employees' accidents and injuries.

The 31-items of safety training questionnaire was pilot tested (along with other questions related to participants background) in August 2008 with a sample of 50 employees from one of the department of the current manufacturing plant. The Cronbach alpha testing was carried out for each of the scale. Based on the pilot study results, three questions has been removed to improve the Cronbach alpha value more higher. The finalized questionnaire of safety training scale was composed of 28 items; eight items on safety knowledge and skill transfer, six items on safe work behaviour, eight items on safe work practices and six items on safety attitude changes. A set of demographics factor consist of 7-items measure participant background, (i.e, age group, gender, department, designation, tenure, type of employment and working shift). One item measure accident history (Safety Outcome) in the last twelve months and one item measure type of injury. Finally, participants are asked to tick one question of safety training course that had been attended. Two phase of data collection has been carried out in one of Malaysian manufacturing plant in 2008 and 2009. The response rate was 83% (N=330) in 2008 and 98% (N=402) in 2009.

2.2 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was used to detect the presence of meaningful patterns among twenty-eight (28) safety training impacts items and summarize the important contained in a small set of factors or dimensions (Comrey & Lee,1992). Principal component analysis revealed the presence of four factors with eigenvalues exceeding 1, explaining 48.10 percent, 17.61 percent, 12.83 percent and 4.56 percent of the variance respectively. The scree plot shown a clear break after the third factor. Given the large sample size, and the convergence of the scree plot and Kaiser's criterion on three factors, this is the number of components that were retained in the final analysis. This decision was further supported by the result of Parallel Analysis, which demonstrated only three factors with eigenvalues go above the corresponding criterion for a randomly generated data matrix of the sample size (22 variables x 375 respondents). The three factors solution explained a total of 78.54 percent of the variance, with Factor 1 contributing 48.09 percent, Factor 2 contributing 17.61 percent and Factor 3 contributing 12.84 percent. The items that cluster on the same factors suggest that Factor 1 represent Knowledge and Skill Transfer, Factor 2 represent Safe Work Practices and Factor 3 represent Safety and Risk Understanding. All three factors of the safety training

questionnaire had high reliabilities with Cronbach's α exceeding 0.8 (Factor 1 = 0.97, Factor 2 = 0.90 and Factor 3 = 0.81). Therefore these three factors will be used for the subsequent analysis.

3.0 FINDINGS

Objective (1): To examine employees' judgment on safety training impacts over a period of time

The first objective in this study was to examine changes on production workers perceptions on safety training impacts from Time 1 and Time 2. In order to investigate mean differences in safety training dimensions mean score for Time 1 and Time 2 a one-way between-groups multivariate analysis of variance (MANOVA) was used. Three dependent variables were used; *Knowledge and Skill Transfer*, *Safe Work Practices* and *Safety and Risk Understanding*. The independent variable was time; Time 1 (2008) and Time 2 (2009). Prior conducting MANOVA preliminary assumption testing was conducted to check for

normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. There were no serious violation found and MANOVA deemed to be appropriate. There was a significant difference in Safety Training Impacts dimensions when data from Time 1 was compared to data in Time 2, with an overall Pillai's trace of .665 (df = 696); partial eta squared = .665. When results for the dependent variables were considered separately (ANNOVA), all factors reach statistical significance, using a Bonferroni adjusted alpha level of .017. There were *Knowledge and Skill Transfer*, $F(1,696) = 445.55$, $p = .000$, partial eta squared = .390; *Safe Work Practices*, $F(1,696) = 247.033$, $p = .000$, partial eta squared = .261; *Safety and Risk Understanding*, $F(1,696) = 1371.580$, $p = .000$, partial eta squared = .663. Table 1 compares the mean scores of safety training dimensions in both times. It is apparent from this table that in Time 2, levels of *Knowledge and Skill Transfer* ($M = 54.18$, $SD = 5.60$), *Safe Work Practices* ($M = 21.57$, $SD = 2.71$) and *Safety and Risk Understanding* ($M = 19.80$, $SD = .687$) mean score was reported slightly higher compared to in Time 1.

Table 1 Production workers perceptions on safety training dimensions in time 1 and time 2

Safety Training dimensions	Time 1		Time 2		Differences
	Mean	SD	Mean	SD	
Knowledge and Skill Transfer	44.50	6.529	54.18	5.609	9.68
Safe Work Practices	18.28	2.830	21.57	2.715	3.29
Safety and Risk Understanding	15.27	2.251	19.80	0.687	4.53

Note: SD=standard deviation

Objective (2): To examine association between safety training and safety outcome (accident rate) over a period of time

To determine whether safety training impacts is negatively associated with safety outcome, Pearson product-moment correlation coefficient was used. Preliminary analyses were performed to ensure no serious violation of the assumption of

normality, linearity and homoscedasticity. The result obtained from the correlation between safety training dimensions and accident rate for Time 1 and Time 2 can be compared in Table 2. It is apparent that, In Time 1, there was a significant medium negative correlation between all safety training impacts dimensions and accident rate. It implies that the higher the level of safety training the lower the accident rate.

Table 2 correlation between safety training dimensions and workplace accident in time 1 and time 2

Dimensions	Time 1	Time 2
	Workplace Accident	Workplace Accident
Skill and Knowledge Transfer	-.262**	.009
Safe Work Practices	-.271**	.016
Safety and Risk Understanding	-.245**	-.021

**p<0.01

However, in Time 2 there was no significant correlation was found between safety training dimensions and accident rate. It can be said that in Time 2, the higher the level of safety training dimensions, the accident rate remain constant. Comparing these two results, it can be said that it might be assumed that higher safety training score and less accident rate (only 2 cases) in Time 2 could possibly contribute to this result as shown in Table 2.

4.0 DISCUSSION & CONCLUSION

Objective (1): To examine employees' judgement on safety training over a period of time

The first objective sought to examine whether there is differences in the safety training impacts mean score over a period of time. Results of mean differences suggest that there was a significant

improvement on all safety training impacts dimensions as perceived by the employees. The significant differences in safety training impacts mean score indicates that the employees' perceived their level of safety knowledge and skill transfer, safe work practices as well as their risk and safety understanding higher in Time 2. This finding is consistent with those of other studies and suggests that employees who have received appropriate safety training are expected to enhance their safety knowledge, safety attitude, and safety behaviour as well as perform work activities in a safe manner (for example; Harrington & Walker, 2006; Goetch, 2005; Jensen, 2005). This finding may be explained by the fact that the knowledge, skill and ability (KSA) gain in safety training attended by employees has been transferred to the real job context effectively.

The observed increases in all safety training dimensions in Time 2 could be attributed to the transfer of training. As asserted by Baldwin & Ford (1988), transfer of training is conceptualised

as the degree to which KSA gained in a training program is successfully applied, generalized and maintained over the period of time in the job context. Differences in safety training scores in Time 2 suggest that employees' perceived safety training positively, by demonstrating that they had practiced and applied what they had learned in their safety training to their work over a period of time. This kind of training transfer is related to retention of KSA acquired from the safety training. Patrick (1992) states that retention can be viewed as a 'special case' of transfer, as trainees are required to transfer their KSA to the same task over a period of time. This argument holds true due to the reason that participants in this study were asked to answer the same questionnaire survey relating to safety training after a twelve months gap. The KSA gained during the safety training had been stored in their memory for a period of time in order to apply it to perform a particular task. Improvement in safety training impacts in Time 2 may be explained by the fact that on-the-job training (OJT) takes place in an organization. OJT normally occurs in organisation in two ways; it might be conducted on an informal basis or formal basis (Blanchard & Thacker, 2004). Since there were no specific interventions of safety training conducted in between times, then OJT might happen, where more experienced and skilled employees, trained the less-skilled and experienced ones. The results of this study imply that safety training helps to facilitate employees to gain safety knowledge and skills, perform safe work practices and increase their understanding on safety and risk.

Objective (2): To examine the relationship between safety training impacts and safety outcomes (workplace accident) over a period of time

This second objective sets out to examine the relationship between safety training and safety outcomes (workplace accident) in Time 1 and Time 2. Result indicates that at both time the strength and direction of the relationship were somewhat different. In Time 1, results show a negative relationship between safety training and workplace accidents. However, in Time 2, results show a constant relationship between safety training and workplace accidents. This result would suggest that there was no association between these variables in Time 2. The present findings in Time 1 are consistent with those Dong *et al.*, (2004) and Kinn *et al.*, (2000), Burke *et al.*, (2008) who found that safety training negatively related to workplace accidents. By linking the safety training to the workplace accident rate, this study provides important evidence of the effectiveness of training in reducing the workplace accident among manufacturing employees. This is a likely explanation that safety training provides and prepares employees to carry on activities that lead to a fewer accidents and injuries (Burke *et al.*, 2008).

The constant relationship between safety training and the workplace accidents rate in Time 2 is likely to be due to the fact that there was a significant reduction in the number of accidents reported in Time 2. This substantial reduction was possibly because of the transfer and retention of safety training. This argument holds true due to the reason that in Time 2, the safety training impacts mean score is higher and the accident rate is lower compared to Time 1. It is expected that if the level of safety training perceived by employees is high, then the accident rate reported should be lower. This finding is in agreement with Johnston *et al.*, (1994) who point out that the ultimate goal of workplace safety training is injury prevention and control. Furthermore, the reduction of the frequency and severity of accidents and injuries is defined by Kirkpatrick (1998) as the final results (Level 4) that occurred due to the reason that the participants attended the training program (Kirkpatrick, 1998). It

is likely therefore, that safety training has been effectively increasing employees' safety awareness on risk and hazards through the acquisition of KSA and is demonstrated by a substantial reduction of workplace accidents. In addition, Mishra & Strait (1993) indicate that effective safety orientation contributes to the organizations' cost savings and is a means to 'lasting and productive results'. The implications of this findings are that safety training can have a positive preventive effect and appear to be effective in reducing accidents and injuries in the workplace. It appears that safety training enhanced employees' safety knowledge and skill that is therefore they equipped with appropriate safety knowledge and being more aware to avoid workplace accidents. Substantial reduction in workplace accident rates in Time 2 indicate that employees were aware of the risk, hazards and dangers at their workplace.

5.0 CONCLUSION

The study has gone some way towards enhancing our understanding of transfer and retention of safety training. There appear over a period of time, safety training impacts as measured by various dimensions has been improved over a period of time due to the reason that transfer of safety training knowledge and skill occurred within the job context. Likewise, retention of knowledge in which employees' stored what they had learned in their memory and required to transfer their knowledge and skill to apply it to perform a particular task over a period of time had also been demonstrated. This finding indicates that knowledge and skill from safety training program is successfully applied, generalized and maintained over the period of time in the job context. Safety training appears to have negative correlations with safety outcomes (workplace accidents). Therefore it can be said that safety training is an effective way in reducing workplace accidents as it prepares employees to engage in activities that lead to fewer accidents and injuries. These findings highlight the importance of incorporating organizational factors and relevant organizational constructs (safety outcome) in order to improve organizational safety performance. These findings add to a growing body of literature on the role of safety training as preventative indicator towards safety outcomes. However, it is suggested that safety outcomes should be assess using other aspects of safety outcomes (i.e, actual accident data, safe/unsafe behavior, safety compliance, safety motivation) in order to determine the effective role of safety training and safety climate.

References

- Aguinis, H., & Kraiger, K. 2009. Benefits of Training and Development for Individuals and Teams, Organizations and Society. *Annual Review of Psychology*. 60: 451–474.
- Baldwin, T. T., & Ford, J. K. 1988. Transfer of Training: A Review and Direction for Future Research. *Personnel Psychology*. 41.
- Burke, M. J., Chan-Serafin, S., Salvador, R. O., Smith, A., & Sarpy, S. A. 2008. The Role of National Culture and Organizational Climate in Safety Training Effectiveness. *European Journal of work and Organizational Psychology*. 17(1): 133–152.
- Burke, M. J., Sarpy, S. A., Smith-Crowe, K., Chan-Serafin, S., Salvador, R. O., & Islam, G. 2006. Relative Effectiveness of Worker Safety and Health Training Methods. *American Journal of Public Health*. 96(2): 315–324.
- Burke, M. J., Sarpy, S. A., Tesluk, P. E., & Smith-Crowe, K. 2002. General Safety Performance: A Test of a Grounded Theoretical Model. *Personnel Psychology*. 55: 429–457.
- Cheung, K. C., & Spickett, J. 2007. Laboratory Safety Training: Influence on Knowledge and Attitudes of Undergraduate Students in Hong Kong. *Journal Occupational Health Safety-Australia/New Zealand*. 23(2): 187–194.

- Cohen, A., & Colligan, M. J. 1998. *Assessing Occupational Safety and Health Training: A Literature Review*.
- Colligan, M. J., & Cohen, A. 2004. The Role of Training in Promoting Workplace Safety and Health. In J. Barling & M. R. Frone (Eds.). *The Psychology of Workplace Safety*. Washington DC: APA Books.
- Comrey, A. L., & Lee, H. B. 1992. *A First Course in Factor Analysis*. Second ed. New Jersey: Lawrence Erlbaum Associates.
- Cooper, M. 1998. *Health and Safety Training*. Second ed. London: Financial Times Management Briefing.
- Cooper, M. D., & Phillips, R. A. 2004. Exploratory Analysis of the Safety Climate and Safety Behavior Relationship. *Journal of Safety Research*. 35: 497–512.
- Dong, X., Entzel, P., Men, Y., Chowdhury, R., & Schneider, S. 2004. Effects of Safety and Health Training on Work-related Injury Among Constructio Laborers. *Journal of Occupational Environment Medicine*. 46(1222–1228).
- Elangovan, A. R., & Karakowsky, L. 1999. The Role of Trainee and Environmental Facors in Transfer of Training: An Exploratory Framework. *Leadership & Organization*. 20(5): 268–275.
- Gillings, S. C., & Kleiner, B. H. 1993. New Development in Health and Safety Programmes. *Work Study*. 42(5): 9–12.
- Glendon, I., Clarke, S., & McKenna, E. 2006. *Human Safety and Risk Management*. 2nd ed. Boca Raton: Taylor & Francis.
- Goetsch, D. L. 2005. *Occupational Safety and Health for Technologists, Engineers and Managers*. New Jersey: Prentice Hall.
- Goldenhar, L. M., Moran, S. K., & Colligan, M. 2001. Health and Safety Training in a Sample of Open-shop Construction Companies. *Journal of Safety Research*. 32(237–252).
- Griffin, M. A., & Neal, A. 2000. Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge and Motivation. *Journal of Occupational Health Psychology*. 5(3): 347–358.
- Harrington, S., & Walker, B. L. 2004. The Effects of Ergonomics Training on the Knowledge, Attitudes and Practices of Teleworkers. *Journal of Safety Research*. 35: 13–22.
- Harvey, J., Bolam, H., Gregory, J., & Erdos, G. 2001. The Effectiveness of Training to Change Safety Culture and Attitudes within a Highly Regulated Environment. *Personnel Review*. 30(6): 615–636.
- Health and Safety Executive. 2000. *Safety Culture Maturity Model*, HSE, HSE Books.
- Jensen, R. C. 2005. Safety Training Flowchart Model Facilitates Development of Effective Courses. *Professional Safety*. (February), 26–37.
- Johnston, J. J., Cattedledge, G. T. T., & Collins, J. W. 1994. The Efficacy of Training for Occupational Injury Control. *Occupational Medicine: State of the Arts Reviews*. 9(2): 147–158.
- Kaminski, M. 2001. Unintended Consequences: Organisational Practices and their Impact on Workplace Safety and Productivity. *Journal of Occupational Health Psychology*. 6(2): 127–138.
- Kinn, S., Khunder, S. A., Bisesi, M. S., & Woolley, S. 2000. Evaluation of Safety Orientation and Training Programs for Reducing Injuries in the Plumbing and Pipefitting Industry. *Journal of Occupational Environment Medicine*. 42: 1142–1147.
- Kirkpatrick, D. L. 1998. *Evaluating Training Programs The Four Levels*. 2nd ed. San Francisco: Berret Koehler.
- Kraiger, K., Ford, J. K., & Salas, E. 1993. Application of Cognitive, Skill-Based, and Affective Theories of Learning Outcomes to New Methods of Training Evaluation. *Journal of Applied Psychology*. 78(2): 311–328.
- Lingard, H. 2002. The Effect of First Aid Training on Australian Construction Workers' Occupational Health and Safety Motivation and Risk Control Behavior. *Journal of Safety Research*. 33: 209–230.
- Lippin, T. M., Eckman, A., Calkin, K. R., & McQuiston, T. H. 2000. Empowerment-based Health and Safety Training: Evidence of Workplace Change from Four Industrial Sectors. *American Journal of Industrial Medicine*. 38(697–706).
- Marsh, T. W., Robertson, I. T., Duff, A. R., Phillips, R. A., Cooper, M. D., & Weyman, A. 1995. Improving Safety Behaviour Using Goal Setting and Feedback. *Leadership & Organization Development Journal*. 16(1): 5–12.
- Materna, B. L., Harrington, D., Scholz, P., Payne, S.F., Stubbs, H.A., Hipkins, K., Coyle, P., & Uratsu, C. 2002. Results of an Intervention to Improve Lead Safety among Painting Contractors and Their Employees. *American Journal of Industrial Medicine*. 41: 119–130.
- Mukherjee, S., Overman, L., Leviton, L., & Hilyer, B. 2000. Evaluating of Worker Safety and Health Training. *American Journal of Industrial Medicine*. 38: 155–163.
- Oberman, G. 1996. An Approach for Measuring Safety Training Effectiveness. *Occupational Health & Safety*. Dec, 48–49.
- Oskamp, S. 1977. *Attitudes and Opinions*. New Jersey: Pentice Hall.
- Patrick, J. 1992. *Training: Research and Practice*. London: Academic Press.
- Rundmo, T. 1994. Assessment of the Risks of Accidents Amongst Offshore Personnel. *University of Trondheim, Trondheim*. 1–135.
- Sinclair, R. C., Smith, R., Colligan, M., Prince, M., Nguyen, T., & Stayner, L. 2003. Evaluation of Safety Training Program in the Three Food Service Companies. *Journal of Safety Research*. 34(547–558).
- Smith, P. M., & Mustard, C. A. 2007. How Many Employees Receive Safety Training During Their First Year of a New Job? *Injury Prevention*. 13: 37–41.
- Tophoj, B. 2006. Fundamentals for Developing Effective Safety Training. *Journal of Chemical Health & Safety*. (September/October), 1–4.
- Yu, S. C.-K., & Hunt, B. 2004. A Fresh Approach to Safety Management System in Hong Kong. *The TQM Magazine*. 16(3): 210–215.
- Zierold, K. M., & Anderson, H. 2006. The Relationship Between Work Permits, Injury, and Safety Training Among Working Teenagers. *American Journal of Industrial Medicine*. 49: 360–366.
- Zohar, D. 1980. Safety Climate in Industrial Organizations: Theoretical and Applied Implications. *Journal of Applied Psychology*. 65(1): 96–102.