

Integration of Behaviour-Based Safety Programme into Engineering Laboratories and Workshops Conceptually

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Abstract

The purpose of this conceptual research framework is to develop and integrate a safety training model using a behaviour-based safety training programme into laboratories for young adults, during their tertiary education, particularly in technical and vocational education. Hence, this research will be investigating the outcome of basic safety knowledge among young adults and precautions needed to avoid occupational accidents and work-related diseases before they are exposed to real-life working situations. Numerous findings have found young adults are more prone to accidents compared to older adults and it happens due to lack of effective safety training and ineffective dispersion of safety knowledge to the young adults. An explanatory mixed method design is suggested for use as the main method; quantitative in the form of questionnaire based and supported by short interview in qualitative methods. A pre-test post-test non-equivalent control group design (with delayed post-test) is identified and it will use questionnaires (based on Theory of Planned Behaviour with an extension of a cognitive mediator) to predict and identify the changes in the safety practices behaviour of engineering students. Behaviour Based Safety (BBS) programme and Standard Safety programme will be used as individual interventions and integrated in the engineering laboratories; whilst the traditional programme will be monitored as the control group method. Three groups of purposive sampling engineering students will be selected and two of the groups will undergo different interventions concurrently leaving one group intact for control measurement. The expected results of analysis of variance (ANOVA) for pre-test, post-test and delayed post-test data between Behaviour Based Safety (BBS) programme, Standard Safety programme and traditional programme will determine the most effective among intervention safety programmes conducted for the engineering students. These future findings should also be able to provide proof that the combination of safety education and safety behaviour based training is the best method to be integrated as effective intervention into the engineering students' safety practices behaviour at the laboratories. The expected findings will help to develop an effective ways of educating and training young adults about work safety, which can be used in engineering laboratories and workshops.

Keywords: Behaviour based safety, Engineering laboratories, Safety education, Safety instruction, Safety training, Young adults, Young workers

1. Introduction

Occupational accidents and fatality among workers pose challenging issues for the Department Of Occupational

Safety And Health, safety practitioners and employers in identifying the causes of accidents, renewing debates on the best ways to decrease occupational accidents. Based on the data disclosed, approximately 960,000 workers are injured in occupational accidents every twenty four hours with 5,330 fatalities caused by work related diseases (Hämäläinen, Leena Saarela, & Takala, 2009). In 1998, a total of 345,000 deaths due to occupation accidents was recorded and this increased to almost 360,000 fatalities in 2002. Furthermore, in 1998, each of the 260 million occupational accidents recorded caused a minimum of 3 working days lost (Hämäläinen, Takala, & Saarela, 2006; Takala, 1999), increasing the operating costs for employers. Losses due to occupational accidents and work related diseases have been estimated to be worth USD 1.36 trillion, equivalent to 4 percent of World Gross National Product (GNP) (Hämäläinen, et al., 2006; Takala, 1999).

In Malaysia, the Social Security Organisation of Malaysia (SOCSO) 2008 annual report states that, in 2007, SOCSO recorded estimated USD 428 million (56,339 cases) paid out to accident victims compared to estimated USD 390 million with 58,321 cases in 2006. As in SOSCO Annual Report 2007, the total no. of occupational accident cases reported stood at 40,617 in 2006 and this figure dropped to 38,657 in 2007. Unfortunately during the same period, the total no. of fatal cases increased to 1,014 compared to only 928 cases in 2006 (Social Security Organisation, 2007, 2008). However, the payout is still increasing, even though the annual number of accident cases has decreased. This is a disturbing development; one which requires serious attention and concerted effort from all parties not only to reduce the number of occupational accidents but also fatalities.

According to an international review conducted, young workers reportedly have a higher injury rate compared to older workers (Salminen, 2004). Young workers are identified as workers below the age of 25 years old. Different countries have different sets of age group defined as young workers and the ceiling age defined is 24 years old based on research conducted. As support to Salminen's (2004) findings, other researchers also concur with the high rate of occupational injuries among young adults (workers under 24 years old) as compared to older age groups (Chin, et al., 2010; EU-OSHA, 2007; Hämäläinen, 2009; Hämäläinen, et al., 2006; Laflamme, 1996; Loughlin & Barling, 2001; Salminen, 2004; Schulte, Stephenson, Okun, Palassis, & Biddle, 2005; Takala, 1999; Westaby & Lee, 2003; Zakocs, Runyan, Schulman, Dunn, & Evensen, 1998).

In Malaysia, Social Security Organisation of Malaysia's (SOCSO) 2008 annual report states that highest fatality rate is among the age group between 20-24 years old, with 203 cases in 2007 as compared to only 177 cases in 2006. These facts and figures show the severity of the accident outcomes among young adults and the fatality rates identify the young workers' group as the most vulnerable age group in occupational accidents. It has been established that the increasing number of occupational accidents involving young workers also attributed to an increase in fatality rates in occupational incidents internationally. Due to the similarities in these statistical reports, the data shows that young adults in Malaysia face a similar situation as their counterparts in other developed countries, that is, young workers are more vulnerable to occupational accidents compared to their older counterparts. Hence, occupational accidents among young adults should be taken seriously by all, employers and unions, in particular. More effective and efficient activities such as training, education and research are required urgently to suppress and control the increasing number of accidents among all workers particularly, those in the young workers' age group especially for the technical and vocational based.

2. Safety Needs in Technical and Vocational Education and Training (TVET)

The Malaysian Law, Occupational, Safety and Health Act (OSHA) of 1994 was written and gazetted to provide provisions for securing the safety, health and welfare of workers and for protecting against safety and health risks in relation to the activities of workers environment except for the jurisdictions subject to the Merchant Shipping Ordinance 1952, Merchant Shipping Ordinance 1960 of Sabah and Sarawak and the Armed Forces (Occupational Safety and Health Act, 2007). In OSHA 1994, Part IV (for employer) and Part VI (employees) are used to ensure that all workers, vendors and customers on the premises are working in a safe condition. All teachers and students in Malaysia are bound by the Act, as stated (NIOSH, 2010); therefore, it also includes technical and vocational education. Although the Occupational Safety and Health (OSH) Act 1994 has been gazetted for almost 17 years, the OSH Act is still not widely practised among workers. Almost 10 years after the OSH Act 1994 was gazetted, a directive was issued by the Chief Secretary to the Government of Malaysia on 20 August 2004 that the implementation of OSH Act in the government sector is needed to adhere to the requirements of the OSH Act 1994 (JKKP, 2010). It can be inferred from this directive that the implementation of the OSH Act of 1994 in the government sector is still far behind from its targeted level. Technical and Vocational institutions under the Ministry of Higher Education and Ministry of Education Malaysia respectively such as polytechnics, vocational schools and community colleges are the most important institutions to upkeep their safety practices because their students or trainees are constantly exposed to actual hands-on work, practical workshops and laboratory work. If safety practices among them are not at par with current internationally accepted practices and needs of occupational safety

and health, these young adults (students or trainees) have a high possibility of ending up as occupational accident statistics. Lack of safety training among young adults' phenomenon does not only happen in Malaysia but also in other developed countries such as the United States of America and also Europe. In the United States, a research conducted by Breslin et al. (2007) revealed that a large number of workers are untrained or not correctly trained, even though safety training is regulated by the legal Act. These data warrant an instant need for OSH practitioners or researchers to explore and identify the best solution to ensure that the training obtained by young workers are relevant and applicable.

Besides the existence of improper training, the high cost of occupational accidents incur cannot be ignored. In most of the economical sense, dollars and cents spent is important in the current competitive and borderless business world. Occupational accidents among workers make up a hefty sum of expenditure on direct and indirect costs in the engineering industries. The direct cost is known as the cost related directly to the workers and also the losses borne due to accidents. In terms of indirect cost, it is the cost related to the hidden costs; which the employers need to fork out as consequences of an accident, such as overtime wages for relief workers. Based on Salminen's (2004) review of findings in high accident rates among young adults, the recorded rates have developed a pressing public health issue, especially when the job market for young vocationally qualified workers is booming in developed and developing countries. In 1999, Miller (1999) found in the United States, an estimated 84,000 teenage workers required treatment in hospital emergencies, with the direct and indirect costs of occupational injuries borne by the employers. The direct and indirect costs of occupational injuries among teenage workers are estimated to be almost 5 billion USD annually (Miller T., 1998). According to the Malaysia Social Security Organisation (SOCISO) 2006 Statistics Report (Social Security Organisation, 2007) and 2007 Statistics Report (Social Security Organisation, 2008), more deaths were recorded among the 20-24 year old age group compared to other age groups, even though the number of total fatal cases decreased. In Malaysia, Social Security Organisation (2007,2008) recorded a payout of USD 428 million in 2007 compared to USD 390 million in 2006. These statistics do not include the indirect costs and as a rule of thumb, it is estimated to be 3 to 5 times of the direct cost (H. W. Heinrich, 1959; Laufer, 1987; Leopold & Leonard, 1987). By applying the estimated theory in indirect costing, occupational accidents and fatalities can be calculated to cost billions of dollars each year. Furthermore, this situation is considered alarming, as not all cases were reported or recorded and the actual costs may be higher than reported. Controlling occupational accidents and fatality rates by using preventive measures are considered the best solution to lower the costs of occupational accidents.

Currently, Occupational, Safety and Health (OSH) in Technical and Vocational Education and Training (TVET) is one of the major items on the agenda discussed in Quebec Protocol (ISSA, 2003), Bonn Declaration (Fien & Wilson, 2005) and also in the sustainability agenda in TVET (UNESCO-UNEVOC, 2004). Based on the Quebec Protocol, there is a list of principles, recommendation measures and process to integrate OSH into TVET. Several developed countries and institutions via education have ensured that the protocol framework is able to contribute to the prevention of industrial accidents and occupational diseases. As all countries have their own occupational safety and health legislation to control their own countries' industrial and occupational accidents, this protocol recommends steps to be used for hazards prevention at the workplace and avoiding industrial accidents and occupational diseases. This protocol was developed by a number of TVET professionals for these purposes. As such, its implementation ought to be adopted and adapted in Malaysia.

Beside the Quebec Protocol for developed countries, Bonn Declaration is a declaration used by the international experts on Technical and Vocational Education and Training (TVET) in line with the needs for Learning for Work, Citizenship and Sustainability in 2004. Based on the Bonn Declaration, the third declaration states it is our responsibility to equip workers with knowledge on safety skills competencies, skills, values and attitude which in turn will make them responsible and productive. Inevitably a sense of pride and appreciation of their work would be cultivated (UNESCO-UNEVOC, 2004). This declaration has proven the importance of the integration of occupational safety and health into TVET for future sustainability of a younger workforce. It is believed that unethical and unsafe values of employers are the downfall of a safe sustainability society. These employers would misuse their positions for personal gains and obtaining the highest profits regardless of their workers' safety environment and practices. Unfortunately, unsafe practices would become the workers' standard practices (unsafe behaviour) after a long duration of unsafe practices and when they are promoted to be management officers, they will emulate these unsafe practices in their future management skills. This practice would create a vacuum for effective safety practice in society. These unethical practices and values have revealed the needs and importance of developing a well responsible and ethical young adults for sustaining safe practices in societies.

In addition, the fact sheet from the European Union (EU) has revealed the safety needs among young adults through European Agency for Safety and Health at Work. Based on the fact sheet No. 70 (EU-OSHA, 2007), there are a

number of reasons why young workers need to have more appropriate training and education. This safety agency has identified three main causes of accidents among young workers; a lack of experience in the field, failure of employer in providing appropriate training and the lack of awareness of safety and health issues. This agency has come out with a few recommended research or practices that could be emulated in ensuring that young adults are able to identify hazards and avoid accidents. The recommendations are OSH should be implemented in education particularly for young adults entering hazardous jobs and young adults who have not received training or lack training at work. Besides that, young adult workers who are at high risk and hard to reach should not be discarded from receiving the OSH treatment even though it is a harder to handle. These recommendations should be taken seriously as Malaysia shares similar status in terms of occupational safety as that of other developed countries such as United States of America and European Union (EU) nations. As Malaysia progresses towards being a developed country by year 2020; equal emphasis should be made on the safety practices and research on young workers. It is to ensure our country is at par with other developed countries in terms of effective safety practice and also to generate a much lower occupational accident rate.

Reference and proper literature for safety application in TVET are important for educators, practitioners and OSH researchers because they are important sources of information used for developing and implementing effective safety practices. Reisenberg (2003) found that there is no practical literature to be used for assessing the role and value of OSH training in vocational education. Apart from that, most of the studies concluded their findings based only on observational results rather than on experimental (Berghaus, 2010). Even though there are limited data from experimental research, all safety practitioners still support and consented to demonstrate the importance and effectiveness of, as well as the need for OSH training at the workplace. Due to the lack of scientific research, most of the safety training procedures conducted are based on non-scientific proven theories and the norms in practices passed down from unknown sources. When the effectiveness of the training is not properly studied, it may cause loss of human lives due to misguided application of the safety information and practices. It is time for more research to be conducted on behaviour based safety as it is currently one of the most widely used in the safety industry particularly, safety in engineering laboratories. It can be concluded from these reviews that there is a need to conduct a research testing for a new well developed training programme and set of procedures to instill effective safety practices behaviour among young adults.

3. Causes of Occupational Accidents and Fatality among Young Workers

Identifying the safety needs in TVET is just the tip of the iceberg for explaining the inefficiency and ineffectiveness of a safety system conducted. One of the solutions for the ineffective system is to obtain a sound explanation by identifying the causes of occupational accidents. Based on a survey conducted (Institute of Medicine, 1998), the findings show 54 percent of injuries involving youths are due to the absence of instructions for preventing injuries and the lack of proper training on safety precautions when using equipment. Young adults involved in accidents have found that they do not know the proper procedures or the risks involved in their work. Furthermore, these conditions are supported further by Loughlin & Barling (2001) findings where the statistics of youth workplace casualties are considered to be underreported due to inexperience, lack of training and vulnerabilities of young workers. Young workers feel it is difficult to report injuries when, from their perception, the job is a low risk occupation and they are under pressure because they are unable to lose their job as it is their means of survival. The predictions of growing low-skill workers in low-wage service sector will make workplace safety more difficult, as workers are easily available to replace injured workers (Loughlin & Barling, 2001). In certain conditions, such as working in shifts, the employers deny the workers' rights to refuse to work in unsafe conditions. The employers use replacement workers as a threat to the young workers. These situations have made young workers shy away from reporting the accidents to safeguard their jobs. It can be concluded that lack of training and understanding of their safety right, these young adults are continuously exposed to exploitation and high risk of injuries at work.

A part of no proper training and easy replacements of workers, insufficient and ineffective law enforcement has been identified as a part of the causes. A series of studies conducted have shown a large population of young adults still do not receive any training even though safety training in the United States is regulated by legislation (Curtis Breslin, Polzer, MacEachen, Morrongiello, & Shannon, 2007). Not much records or researches to be found to show the insufficient of enforcement as most law in OSH is self regulated. The only way to find the weakness of lack of training is when the accidents and injuries have occurred. After investigation, none of the employers has been taken legal action against for no proper training but they are just charged on malpractice of improper or unhealthy environment. A part from that, the employee themselves will be charged if they are found guilty for not following proper procedures. The employees would not report the accidents and this causes the low accident reports received for safety training. This is an important part of the system failure. It reflects the workers are not educated and knowledgeable enough to behave safely and react safely from their own safety rights. In these situations, safety

awareness is needed to be integrated in the training programmes at lower level or younger age at the time where the workers have not exposed to real work yet. This training will help them to identify unsafe situations, environments not to their expectation and how to react towards them. With this knowledge, it is expected of them to be safe, stand for their rights and demand for specific safety training needs based on the workplace or work nature. It will lead to a better sufficient and self regulated enforcement as required by law.

Insufficient safety awareness and safety training among the young workers are identified as part of the causes of occupational accidents. According to Schulte et al (2005), the foundation of technical and vocational education received during high school will affect the technical and vocational students' work experience later in future. These young adults are expected to graduate, change jobs, and safety hazards exposed to them will not be resolved if they are not equipped with generic occupational safety and health knowledge, making them vulnerable to hazards. The unfortunate part is young adults are unable to identify the hazards and danger at a new environment and these situation handicapped them from preventing injuries and also work safely. Humans rely on the similarity of previous experience and knowledge to behave and react in a new environment or situation (Thygerson, 1992). This explains why most accident victims are unable to explain the unintentional injuries and most of them assumed they are conducting the correct behaviour. It has reflected a weakness in basic safety practices behaviour and this practice is largely dependent on the knowledge and training the workers have obtained earlier. Besides that, the contents and the presentation level should be as comprehensive, understandable and adaptable at all levels by tackling the correct issues. This is because findings have indicated youths with working experience do not find safety training sessions offered to them effective in preparing them for hazardous conditions (Zakocs, et al., 1998). Even though safety training and education are given, they did not focus on the specific needs of the workers, occupational accidents would still occur. Therefore, a mismatch between safety education and training and the real work hazards is also an important issue to address in preventing occupational accidents among young workers.

Based on reviews from researchers, the main cause of occupational accidents is the lack of proper safety education and training. Without the right knowledge and training in safety practices or behaviour, the number of occupational accidents will be more fatal as compared to injuries. A comparison study between Crowe (1995) and Blair et. al (2004) has indicated that college students are less safety conscious in self reporting safety values and also in their behaviour as compared to their counterparts a decade ago. Blair et al (2004) suggest implementation of proactive multidiscipline methods of educating young adults and an in-depth critical and systematic evaluation are needed to enhance safety values and behaviour among young adults. The evolvement of the current social scene and education institution environment has indicated to be non-conducive for old methods of developing safety values and behaviour among young adults. Review of the findings has pointed to the need for an effective and adaptable safety training and education for young adults to develop better safety practices in preventing unintentional injuries and occupational death.

4. The Purpose of the Research

In recent research, the behaviour of workers has been the main focus as it is identified to be the root cause of occupational accidents. Researchers have found the changes in behavioural safety are substantial for developing safe conditions (Cox S., 2006; Williams & Geller, 2000). Therefore, types of behavioural-based programmes are the norms for developing safe conditions within organisations or companies in implementing their safety programmes (Cox S., 2006) and known as the most effective way to reduce work injuries (Geller, 2001b). It can be seen that behavioural-based safety has been used extensively in the manufacturing, food processing, construction, nuclear, petrochemical and education industries. The outcome of the research has shown a tremendous change in safety behaviours and also in the reduction of injuries (Dunn, Runyan, Cohen, & Schulman, 1998; Findley, Smith, Gorski, & O'Neil, 2007; Finn, 1978; Håvold, 2005; Hong, Lin, Pai, Lai, & Lee, 2004; Lingard & Rowlinson, 1998; Mullan & Wong, 2009; Schulte, et al., 2005; Törner & Pousette, 2009). For many years, behaviour-based safety programmes have been used for safety training even though little research has been conducted to prove their reliability and validity. To date, behaviour-based safety researchers are still called for conducting proper scientific research study (Berghaus, 2010) to support the behaviour-based safety programme as a reliable and valid training model for young adults.

The proposed study for the research is to investigate the effectiveness of training methods and safety education for the students in obtaining proper training and practices in occupational safety and health at a young age - in secondary or post-secondary institutions, such as polytechnic and community colleges, before they are employed. It is developed based on the findings from Schulte et al. (2005) who believe safety-based training should be conducted for young adults at the learning stage compared to the working stage to prevent occupational accidents and work-related diseases. As argued by Schulte et al. (2005), occupational safety and health conditions for vocational students during their training and in their subsequent careers overlap with the larger issues of safety and health risks

for young workers. They believe that the integration of occupational safety and health information, and training into vocational programmes would benefit both the employers and employees. The benefits include an increase in career knowledge, safer work behaviours, competence when dealing with high-risk occupational situations and reduced occupational safety and health injuries and incidents. Schulte et al. (2005) also found that during post-secondary vocational education may be the only time workers are exposed to occupational safety and health information and training. These suggestions have indicated that the education years are the best years for young adults to be trained and equipped with knowledge about safety before they start working.

Another solution based on the reviews conducted on TVET is by integrating Occupational Safety and Health (OSH) curriculum rather than a cross sectional OSH curriculum. Integrating learning is one of the ways used to evolve the engineering curricular and keeping it relevant to the current situation (Carlson & Sullivan, 1999; McCowan & Knapper, 2002). According to McCowan & Knapper (2002), integration of professional skills such as 'increasing safety and health skills' and safety and health awareness into the engineering curricular as the main objectives to ensure the engineering undergraduate programme is relevant to the industries. In the cross sectional method, Freeman and Field (1999) have found the main significant benefit of cross functional safety curriculum in one of the engineering courses (*Introduction To Metallic Material And Processes*). They have found that the students are able to practise their profession as in a working environment and at the same time, the students are able to absorb the safety and health principles from the safety curriculum (*The Introduction to Occupational Safety*) (Freeman & Field, 1999). Cross sectional method is just a small section of engineering education derived by combining two modules and applying safety practices in the engineering laboratories. This combination allows the graduates from a particular engineering course to be involved directly and practise safety discipline as a true technical-based profession. The students are able to articulate the risks and dangers during hands-on laboratory work by suggesting changes to prevent injuries. Apart from that, Freeman and Field (1999) emphasise that the students take the situation seriously as suggestions made will have an impact on their peers and their safety. The cross sectional curriculum has demonstrated the effectiveness of safety practice and training. Based on these findings, it is expected to be more effective if the safety practices are integrated into the engineering laboratory or workshop modules where more training hours are used to change the behaviour, attitude and also safety culture among young workers.

Safety Education and Behaviour based safety training will be used as intervention in developing good safety practices among young adults. Based on safety culture development (Geller, 1994, 2001b), three elements which are identified to change safety culture are Knowledge, Behaviour and Environment. If one of the elements changes to create a positive event, it is belief the other two elements will eventually change and achieve a whole positive safety culture. Theoretically, if the two elements were to be changed, the last element; which is environment will have a faster positive changing rate accordingly with the safety education (knowledge) and training (behaviour). Human behaviour is the main target for safety practices as it is estimated that 80 to 90 percent of accidents happened due to human error (H. W. Heinrich, Petersen, D., Roo, N, 1980) and only 20 to 10 percent are related to environmental conditions. Previous findings (Berghaus, 2010; Geller, 2001a, 2001b) have suggested that safety culture particularly safety education and knowledge of OSH do play an important role in changing safety behaviour by developing awareness and ensuring the effective implementation of safety at the workplace.

An instrument will be developed as an accessing tool for the intervention applied and will be based on a self report behaviour questionnaire. As reference to the safety training framework developed by Hong et al. (2004), the framework uses Normative Belief, Behavioural Belief and Cognitive as domains to determine the effectiveness of types of training. The weakness of the research outcome has brought an added suggestion to include self-advocacy to create a real-life condition of decision-making, which will allow young adults to weigh their weaknesses and strengths for working safely (Chin, et al., 2010). The framework has been extended, revolved and develop in a similarity framework as in Theory of Planned Behaviour (TpB) except for the cognitive mediator element. This particular theory is reviewed as a good predictor in actual behaviour with the use of intention as the mediator between the domains and outcome.

The purpose of this research can be summarised in the following objectives:

- i) To develop behaviour-based and standards-based safety training programmes for use in the polytechnic engineering laboratory curricula.
- ii) To determine the behaviour-based safety training programme is more effective as compares to the standards-based and traditional safety programmes for teaching safety skills and safety education for use in polytechnic engineering laboratory curricula.

5. Significance of the Research

According to the SOCSO 2006 Annual Report (Social Security Organisation, 2007) and DOSH 2007 Annual Report

(Department of Occupational Safety and Health, 2007), accident and fatality rates of young adults in the workplace are identified as the highest among all age groups. These reports have highlighted the need to conduct experimental research for identifying ways to decrease occupational accidents among young workers. Most of the reviews have shown that education and training is the best model for the integration of OSH practices in laboratory and practical work for young adults; where the outcome of the model will be measured and evaluated, using statistical and scientific methods. The contents and the levels of the safety education and training should be well presented based on the level of understanding and are comprehensible to all levels and most effective towards young workers. The results of this research will be used as a reference for the future development of safety education and training guidelines in the implementation of OSH in any safety curriculum in technical and vocational education.

Findings from this study will be useful to various factions of users including technical and vocational students, educators, researchers and policy-makers. Technical and vocational students will reap the benefits of OSH training for their future well being; which is to ensure all young adults are educated on safety and free from occupational accidents. Educators will also benefit from the findings and may use them as reference to advocate the integration of OSH training in their practical technical and vocational classes. It will also help to develop a safer environment by educating students on the application of the hazards identification and methods of avoiding risks during classes. Ongoing research can develop an advanced model or programme to complement the findings and also to enhance the effectiveness of the safety information and awareness transfer among young adults.

Furthermore, a well documented research will develop a foundation for the government and policy-makers to enhance current procedures, guidelines and programmes for more practical and effective safety practices and awareness among the new generation of young adults. In addition, the findings will encourage Malaysia's OSH research communities in developing better training programmes locally supported by scientific data.

6. Theoretical Framework

The safety and health training model for petrochemical workers created by Hong et al. (Hong, et al., 2004), was able to demonstrate that the managers in a petrochemical company improved their awareness and attitudes when they were exposed to training courses and have a longer duration of education. Unfortunately for petrochemical workers, training courses did not have a better effect compared to education duration or education level. The research indicates that education level will change their awareness and attitudes towards safety and health concepts. Therefore, the training courses conducted are not suitable for the lower educational level workers as compared to professional workers. The training and the level are too complex and complicated for the workers to understand unlike those in higher positions. The outcome indicates that training development should be modified to fit the workers' level of comprehension (Hong, et al., 2004). A part of developing safety education and training suitable for the higher and lower education levels as a remedy for Hong et al.'s (2004) research, training and educating at young age and level might be solutions to the weaknesses in the safety training model.

Insert Figure 7.1 here

The safety and health training model will be used to identify the types of training suitable for changing behaviour through awareness and attitudes. As suggested by Hong et al. (Hong, et al., 2004), other new factors should be used to determine the awareness and attitudes of the workers towards safety behaviour. According to Dejoy (1996), self-efficacy of a person can be developed using education or training, skill-building and actual experience can alter a person's self-efficacy. As in this research, self-efficacy of the students can be tested by using types of training injected into the safety and health model. The safety and health model is modified as in Figure 7.2. The framework designed by Hong et al. (2004) is an adaptation of the Theory of Reasoned Action (TRA) and by including self-efficacy into the framework, it has revolved into the Theory of Planned Behaviour (TPB). TPB is well known as a good predictor theory for identifying actual behaviour with the use of its abilities to test linkages between attitude, subjective norms and self-efficacy towards behaviour in direct and indirect terms. The only difference of the framework is that the cognitive element has been used as mediating factor toward intention factor.

Insert Figure 7.2 here

6.1 Theory of Planned Behaviour

The TRA generally consists of the following three general components: behavioural intention, attitude and subjective norms. This theory states that a person's behavioural intention depends on the attitude of the person and subjective norms (Ajzen, 1991; Ajzen & Fishbein, 1980). Attitude is the belief about a particular behaviour weighted by evaluations of beliefs (Ajzen & Fishbein, 1980). Subjective norms are the influence of people in one's social environment on one's intention (Ajzen & Fishbein, 1980). In other words, the beliefs of others will influence one's behavioural intention. Therefore, a person's voluntary behaviour is predicted by the person's attitude towards the

particular behaviour and also people's view towards him when he performs the particular behaviour. This shows that attitude and subjective norms will form a person's behaviour (Miller, 2005). The prediction power of TRA has been questioned as most of researchers believe self-efficacy does give an impact on the intention of the human behaviour.

Thus, a new extension theory of TRA was introduced as The Theory of Planned Behaviour (TpB); which perceived behavioural control is added to the theory. It is similar to the self-efficacy construction by Bandura (Blair, Seo, Torabi, & Kaldahl, 2004). Self-efficacy, a partial factor of perceived behavioural control, is known as perception of one's own difficulty in performing certain behaviour. In other words, it relates to how a person looks at their confidence to act on or to perform a certain task or behaviour. All of the human processes are cognitively based; where all the data are articulate and processed by referring to beliefs, norms and self-efficacy of a person before a decision is made to react and behave. These beliefs can motivate a person to change their behaviour towards a certain condition or action as mediates by the mode of intent. If interventions are able to change beliefs and self-efficacy of a trained worker, the training and knowledge gained could lead to cognitive process and later processed into positive or negative intention to behave. Therefore, the model developed uses cognition (Hong, et al., 2004) as the outcome of beliefs to reflect one cognitive comparison based on the experience, knowledge and beliefs before moving towards an action. Bandura's research on self-efficacy in 1977 and Icek Azjen's Theory of Planned Behaviour in 1985 show that self-efficacy does play an important role in safety behaviour (Ajzen, 1991). Some research conducted have found that self-efficacy is an important factor in achieving successful behavioural safety programmes (Blair, et al., 2004; DeJoy, 1996). Therefore, as an extension of Hong et al.'s (Hong, et al., 2004) model, it has been suggested to take a look into the effectiveness of self-efficacy in changing awareness. It would test the changes in safety behaviour, in response to the types of safety training offered to the students. This suggested framework will determine the effectiveness of the training due to safety behaviour changes. In addition, the research will look into which of the factors (self-efficacy, normative beliefs and behavioural beliefs) will be the most effective for predicting safety behaviour changes among the polytechnic engineering students.

6.2 Total Safety Culture

A total safety culture concept is developed by Geller (2001b) and also known as "the safety triad". It consists of three domains, environmental, personal and behavioural factors. These factors are similar to those of the Social Cognitive Theory. As one of the factors changes, it will have an effect on the other two domains. As in this research, human dynamics have become our main concern, and therefore, behavioural and personal factors will be addressed in the following explanation. The manipulations of these factors will develop different ways or approaches to understanding and managing human elements, and also representing the psychological aspect of injury prevention. The person-based approach directly relates to individual attitudes and thinking processes. This approach will look in-depth at the students' feelings, attitudes and thinking processes to achieve a better, safer working condition. Education and knowledge are required to change one's beliefs of intentions, and safety education is offered here to change one's intention of beliefs to practise better safety behaviours.

The behaviour-based approach uses applied psychology found in the behavioural science conceptualised by Skinner (1974), as cited by (Geller, 2001b). This approach will identify behavioural goals to be achieved as the agenda of change. For example, the changes in a safe environment to a safer condition and it will be more applicable to workers by influencing the worker's behaviour to change towards safer targeted behaviours. Most of the element manipulations are conducted based on human elements; which are behaviour and person based element because Heinrich (1980) found environment has less impact on accidents and are more expensive. This type of manipulation can be achieved by using the training concept and also education. If both of the approaches are combined, achieving a better safety condition will be faster and effective. The behaviour-based safety training approach; which uses a combination of safety education with safety training, achieves a total safety culture in terms of human elements (Geller, 2001b). Therefore, in the behaviour-based safety training, safety education, together with safety training will help to achieve a total safety culture.

6.3 Standard Safety Training (Person-Based Approaches, Safety education)

Standard Safety training conducted in most organisations is based on knowledge about safety. According to Geller (2001), knowledge is presented in the safety training, rather than hands-on training as a step-by-step procedure and known as safety education. Where knowledge is concerned, it relates more to internal changes in people than to external changes, as in behaviour-based safety training. This condition can be seen when most of the training programmes conducted are lectures and paper-based approaches. These training programmes are geared more towards safety education than safety training.

As example, a green card safety and health Induction Course conducted by the Construction Industry Development Board (CIDB) is a basic standard safety one-day programme. The basic course will introduce basic knowledge of

CIDB functions, its jurisdiction and the safety precautions needed to enter and work at the construction site. Information on safety practices is shown on slides and explained by the instructor. Based on the knowledge given, this standard safety training is emphasised to deal with the internal aspects of a person. Safety training by itself is not effective enough to change one's behaviour toward safety. The standard safety training programme used by Berghaus (2010) is classroom-based and consists of reading assignments and lectures with audio-visual aids. It is conducted over the course of two eight-hour days. The difference between this safety training and the CIDB safety training is that Berghaus's (2010) research uses written test at the end of two days training where as CIDB safety training is just lectures with audio-visual aid. In summary, a standard safety training programme should consist of appropriate content and standard material, dispersing the safety knowledge to the students or future workers by using reading materials and lectures.

6.4 Behaviour-based safety programme (Behaviour Base Approach, Safety training)

A behaviour-based programme has been the typical approach for developing safe conditions within organisations or companies in implementing their safety programmes (Cox S., 2006). It can be seen that behavioural-based safety has been widely used in manufacturing, food processing, construction, nuclear, petrochemical and even education industries. The outcome of the research has shown a tremendous change in safety behaviours and also in the injury cases (Dunn, et al., 1998; Findley, et al., 2007; Finn, 1978; Håvold, 2005; Hong, et al., 2004; Lingard & Rowlinson, 1998; Mullan & Wong, 2009; Schulte, et al., 2005; Törner & Pousette, 2009). A behavioural-based safety programme consists of 4-5 implementation phases of the programme, and it varies depending on the research definition (Cox S., 2006; Geller, 2001b). The contents of the programme are still the same, and most of the four basic steps developed by Geller (2001b) are known as the DO IT process. The first phase is to define (D) the critical target behaviours to increase or decrease, followed by observation (O) to understand the environment of a certain situational influence on the target behaviours. After the source of the target behaviour is known, the intervention (I) process is needed to change the targeted behaviour in the desired direction. After the intervention process is completed, the targeted behaviour will be tested (T) by continuously observing and recording the targeted behaviour during the intervention programme (Geller, 2001a, 2001b). According to Cox (2006), a four-phase implementation of behaviour-based safety programmes consists of preparation for implementation, training and support techniques, designing a checklist for observing behaviour and, managing and maintaining the process, as it is a continuous programme. Reduction of accidents and improvements to overall performance can be seen when the behaviour-based safety programmes are successfully implemented in the organisation (Cox S., 2006).

Even when a programme is working well, there are still criticisms of behaviour-based safety programmes. A number of researchers have questioned the effectiveness of behaviour-based safety training models, as some research conducted have revealed weaknesses and have argued that a behaviour-based safety model cannot be used because not all humans have the same type of behaviour. Smiths (1999) pointed out human behaviour could not be changed thoroughly by a standard type based behaviour training model which emphasises only one type of behaviour. Behavioural based research can be effective for some individuals but not for others. This observation indicates that behaviour-based safety programmes cannot be used to change internal processes in all human beings effectively but requires adaptation (Smith, 1999). Therefore, research has revolved around and used cognition strategies to mediate the weakness found in the behaviourism technique. This condition has been corrected and rectified by Geller (Geller, 2001b), in the development of "The Safety Triad". Internal and external processes of human beings are considered, and the concept of a person-based approach is referred to as an internal change process. A behaviour-based approach is used to change the behaviour of a person, which is defined as an external process of a person. The changes made based on research and development have made behaviour-based safety programmes more reliable and valid for developing a safer condition for all. Unfortunately, Smith (1999) pointed out that behaviour-based motivators destroy the intrinsic motivators of the workers because the Antecedent Behaviour Consequences (ABC) model requires workers to act in certain ways. It shows a contradiction with the intrinsic motivators, which do not adhere to fixed procedures. Therefore, some pros and cons are still unsolved; research should be continuously conducted to seek answers for the given condition and to study in-depth the effectiveness of Behaviour-Based Safety Programmes.

7. Structure of the Research Design

This section discusses the aspects of relating the approaches of data collection and methods of data analysis. Specifically, it covers areas pertaining to research design, population and sampling, research instruments, data collection and suggested data analysis.

7.1 Research Design and Procedures

This research will be conducted using an explanatory mixed method research design known as the QUAN-qual

method. Quasi-experimental research and interviews will be conducted to obtain the data needed for this research. First of all, it will be conducted by using quasi-experimental research to examine and determine the best training method for the integration of OSH practices in the polytechnic curricula. A quasi-experimental research study involves the use of intact groups of subjects in an experiment rather than assigning subjects at random to experimental treatments. In addition, it is also known as the only type of research that can determine a cause and effect relationship by testing the hypothesis (Gay, Mills, & Airasian, 2009; Wiersma, 1992). The design of the quasi-experiment is also known as pre-test post-test non-equivalent control group design. This design is chosen due to its suitability of using classes rather than individual students for the research. Identification of three main engineering groups consists of civil, electrical and mechanical engineering students. The number of students are selected to the nearest equivalent number of student per class as possible. Each method will be exposed to three different classes of engineering students and the methods of safety training and education are Traditional, Standard Safety Training and Behaviour-Based Safety Training. These experiments will be integrated in engineering laboratories as it has been identified that these students have the most exposed risk towards occupational accidents.

The timeline for the experiment is a pre-test implemented before the experiment (before mode) and a post-test to be conducted after the experiment (after mode) after 15 weeks of intervention training (1 semester). Another delayed post-test will be conducted after 3 months of industrial training to look at the effectiveness and the retention ability of the safety education and training. The use of double testing of the post-test would yield a few results that the initial post-test is unable to provide (Gay, et al., 2009). Table 6.1 interprets the quasi-experimental model for this research. The trainers (lecturers) will be trained accordingly to the nature of the experimental and control groups. This step is to ensure that the trainers do not implement other methods during laboratory work and to avoid misguidance as well as to ensure detection of the effectiveness of the experiment.

7.2 Population and Sampling

In Malaysia, a large percentage of semi skilled young workers are polytechnic students and graduates. According to 2008 statistics from the Ministry of Higher Education Malaysia, enrolment in polytechnics stood at 40,574 students (53.9%), private universities and colleges at 17,949 students (23.9%), community colleges at 9,649 (12.8%) followed by public universities at 7,114 students (9.4%) (Statistics Department of Higher Education, 2008).

As for graduate statistics for technical and vocational education in year 2008, polytechnic graduates comprise 62.6 % of total diploma and certificate graduates at 32,783 graduates, whereas private college and university-based graduates stood at 7807 graduates (14.9 percent), followed by public university at 6232 graduates (11.9 percent) and community college at 5566 graduates (10.6 percent). Based on their own category percentile, it is estimated that 53.4 percent (13517) of polytechnic graduates currently work in the industry, private based universities and colleges stood at 62.4 percent (4,871) graduates working, community college at 48.6 percent and public universities at 50.4 percent (Statistics Department of Higher Education, 2008). Based on these statistics, it can concluded that polytechnic institutions play an important role in developing graduates for our country's workforce and are the main player in developing a technical and vocational workforce in Malaysia. Therefore, to achieve the objective of the study, the population will be the polytechnic students.

Specifically, the experiment will be conducted in three categories of engineering classes (Civil, Electrical and Mechanical) at polytechnics in northern Malaysia. The population will be diploma programme students in the third semester, who are expected to undergo their industrial training in the following semester. The polytechnics will be identified based on the engineering course available and other criteria to determine the representation for the polytechnic population. Purposive sampling (Gay, et al., 2009), is used to ensure all of the engineering categories are equally represented, in this case it comprises 120 students in each category.

Each category is represented by all three experimental groups; they are the control groups, standard groups and the behaviour based training groups. Each engineering category is represented by 3 different treatments. In other words, all of the training methods will be represented by electrical, mechanical and civil engineering students. For interviews, purposive sampling is chosen because each sample from three types of teaching method needs to be interviewed. Under this condition, every class will be used. When the classes are determined, the random purposive sampling is used to identify the students in the individual classes to be interviewed.

The experiment could not be individually conducted, as it would be impossible to individually separate students because it would disturb the natural flow of the environment and learning conditions. Therefore, it will be conducted according to classes. Due to this situation, a quasi-experimental research design is chosen. The non-equivalent control group design is chosen because it can determine the extent of group equality, and the pre-test data can be used as the statistical control (Gay, et al., 2009; Veal, 2005; Wiersma, 1998). To avoid misconduct in the experiment, each experimental group will be separately tested among the polytechnics, for which no overlapping or comparisons

between the experimental groups are ruled out because the experimental groups might share knowledge after each experiment, thus affecting the treatment of the experiment and the validity of the experiment.

7.3 Procedures

The procedures in this research are divided into two sections; quasi-experimental research and qualitative research using observation and interviews as shown in Figure 6.1. In the first section, there are three different methods or techniques of training identified, and training for the trainers to conduct the experiment is needed.

7.3.1 Traditional Safety Procedures

Traditional methods used will be identified as the control group method. In the normal environment of running an experiment or laboratory work, the safety explanation is given at the beginning of the semester, when introduction and safety procedures are briefly explained by the trainer. All of the explanations for each and every related safety precaution and procedure are explained during the first class of lecture in the continuum of classes. After this introduction, the safety procedures are not mentioned in the following classes, unless they are mentioned in the laboratory worksheets.

7.3.2 Standard Safety Training Procedure

Standard Safety Training Procedures are provided in each and every laboratory class. They are the stated do's and don'ts at the beginning of the laboratory work, and the students conduct the experiment according to a worksheet. The trainer only demonstrate the procedure at the beginning of each laboratory exercise. No reinforcement or correcting of the safety procedures is implemented. Safe and unsafe acts are recorded, but no praise, corrective feedback or retraining will occur.

7.3.3 Behaviour-Based Safety Training Procedures

Based on behaviour safety training, all standard safety programmes are conducted, followed by a plan of instruction, modelling, rehearsal and praise for correct behaviour or corrective feedback for incorrect behaviour (Geller, 2001b). Safe and unsafe acts are recorded, and retraining of the safety procedures will be implemented until the students are able to complete the work correctly.

7.4 Training Module

The contents of the training module should be person-based (knowledge and education) and behaviour-based (training and change of behaviour). A training session will be conducted for lecturers or teachers as facilitators. This session is to ensure that all models are conducted as ideally as possible for each experimental model implemented in order to avoid any error or misinterpretation of the experiment. The modules of all the trainings will be developed with the help of the lecturers and instructors.

7.5 Instruments

As mentioned in the research design, questionnaires will be used to identify the effectiveness of the implementation of the training types for the pre-test and post-test of the quasi-experimental research. According to Wiersma (1998), a Likert scale survey method is one of the best methods to obtain the respondents' attitudes, because it has a number of scales that allow the respondents to choose the best answer to describe their feelings or perceptions towards certain issues or conditions. The questionnaires will contain instruments to determine the self-efficacy, cognitive, attitude, beliefs and also behaviour changes of the students. The researcher would like to look into which of the factors affect the behaviour most.

The Theory of Planned Behaviour consists of five constructs (i.e., attitude, subjective norms, perceived behavioural control, intention and behaviour). The use of the TPB design questionnaires as the basis for the construction of instruments items is recommended (Ajzen, 1991). Based on Francis et.al (2004) TPB Design Questionnaire Manual, each predictor variables (attitude, subjective norms and perceived behavioural control) can be measured using the indirect measurement (belief based), direct measurement or even both. As recommended by Azjen (1991), the use of the indirect measurement will increase the prediction power and the precision of prediction will be greater. As evaluation instrument, Francis et.al (2004) suggest that direct measurement is efficient enough to evaluate the performance of the behaviour changes. In this theory, safety cognitive ability is included for testing to find out whether this element has an effect on predicting safety practices behaviour.

7.5.1 Attitude

Direct measurement involves the use of bipolar adjectives for evaluative belief and the semantic differential scale will be used for the measurement. The representation of lower numbers show the disagreement and the higher numbers show a greater agreement on their attitudes. The bipolar adjectives items are adapted from (Ajzen, 2001;

Francis, et al., 2004; Johnson & Hall, 2005; Lajunen & Räsänen, 2004; Quine, Rutter, & Arnold, 2001). The Instrumental items will be using the stem “My safety practice in the workshop/ laboratories is...” to capture the behaviour of achieving safety practices of the students and experiential items stem as “When I follow safety practices in the laboratories/workshops/workplace, I feel.....” to capture the feelings in performing safety practices.

7.5.2 Subjective Norms

Direct measurement used a 7 point semantic strongly disagree-strongly agree scale to access the students reaction towards their subjective norms. The items are adapted from TPB safety researches such as safety lifting behaviour (Johnson & Hall, 2005), safety helmet usage (Lajunen & Räsänen, 2004; O'Callaghan & Nausbaum, 2006; Quine, et al., 2001) and Construction of TPB questionnaire manual (Ajzen, 2001; Francis, et al., 2004) using the individual or groups identified in the elicited survey for the students. In this section general subjective norms are presented to determine the effect of others towards their safety practice. The items use phrases such as “It is expected of me.....”, “People who are important to me.....”, “I am expected” and “It is my social responsibility to.....”. These are used to capture the subjective norms in a more general term and to determine whether subjective norms have effects on their safety practices.

7.5.3 Cognitive

The Safety Cognitive Ability of a worker can be used as a predictor of safety practices. As shown by Hong et. al (2004), the higher educated workers tend to behave safely compared to the lower educated workers. This condition is also supported by research findings based on consciousness and cognitive ability towards safety practices (Postlethwaite, Robbins, Rickerson, & McKinniss, 2009). Items on safety cognitive ability on safety practices in the laboratories will be the sub domain under cognitive. All the items will be using a 7-point semantic scale 1 as strongly disagree to 7 strongly agree.

7.5.4 Self Efficacy

Indirect measurement of perceived behavioural control consists of the combination of self-efficacy and controllability of a person's behaviour. Self efficacy will look into how confident of they themselves in carrying out safety practices and the phrases used are “I am confident that I would....”, “I think it is easy....”, “I think I am trained....” and “I will practise.... when I know.....”. If the higher number is chosen, it reflects the respondent has high self-efficacy while a lower number recorded suggests that the outcome is vice versa.

7.5.5 Intent

Based on Ajzen's (2001) recommendation, three basic items are used to determine intention of a person and the stems or the items statement starts as “I intend.....”, “I want...”, and “I plan.....” (Francis, et al., 2004; Johnson & Hall, 2005; Lajunen & Räsänen, 2004). The scale of the items uses a 7-point semantic ranging from strongly disagree to strongly agree. Beside the general intention items, an intention performance is used to enable the participants to rate themselves; out of 10 times given, how many times do they intend to practise safety. A part form that a general intention scale is used to determine how likely they score themselves in practising safety behaviors in the laboratories or workshop. It will be used to differentiate the person's intention level of implementing toward the real behavior.

7.5.6 Behaviour

Items on safety practices are adapted from items (11 items) on safety practices among college students from Crowe (1995) and safety compliance items (7 items) on safety management practices from Vinodkumar (2009). An item is developed based on a single self-report behaviour item used in TPB questionnaire (Ajzen, 2001; Francis, et al., 2004). All the items will be using the 7-point semantic; scale 1 as strongly disagree to 7, strongly agree. It is used to look into their the students' self-report on their safety practices at laboratories and workshops and links the intention, attitudes, subjective norms and perceived behaviour control to their actual self-report behaviour.

7.6 Interview Questions

The interview questions will consist of items on the domains used in the framework and the item statement is changed to question form. The purposes of the interview are to look into the reaction of the students towards the intervention for developing their safety practices in the laboratories, the effects of the intervention towards their current and past safety practices, and the factors of the domain. For example, the intention statement - “I tend to act safely in the laboratories at all time” is changed into “Do you intend to act safely at all times in the laboratories?”. The interview will be recorded in audio form and preferably visually too. The interpretation and transcription of the interviews will be conducted and uses qualitative software such as NVIVO to synchronise the data with the quantitative results for analysis as supporting prove.

7.7 Data Analysis

Descriptive statistics for categorical variables will be presented as numbers and proportioned in percentile, while continuous variables will be presented as mean with Standard Deviation (SD). Two way analysis of variance (ANOVA) will be used to analyse the difference in safety behaviour between the control group (traditional group), intervention groups (standard safety training and behaviour based safety training) and the pre-test, post-test and delayed post-test of intervention. This outcome will reflect the changes of behaviour before, after and retention effective period. Multiple regression is a standard statistics analysis guideline for TPB (Hankins, French, & Horne, 2000) for estimating the association between safety practices behaviour in the laboratories, mediating variables and also independent variable. Guideline for TPB analysis is double multiple regressions to identify the chain reaction from the attitude, subjective norms and self-efficacy towards intention and outcome of the actual behaviour. These analyses will identify which of the factors has the most impact on predicting the behaviour changes and effectiveness of the intervention in behavioural changes.

The suggestion on the use of Structural Equation Modelling (SEM) is also strong due to the complexity of running double multiple regressions for analysis with the analysis conducted in separate analysis each time. The power of SEM is the capability of estimating a whole analysis and it can be stimulated in one simulation by observing the independent, mediating and also dependent variables at the same time. SEM is able to conduct causal modelling, conformation factor analysis, regression modelling, and second order factor analysis and covariance structure models for complex analysis as needed in the research. Alongside to the quantitative method, the visual, audio and notes on the interviews are transcribed and arranged accordingly based on factors and theme concurrent with factors used in the quantitative method. The interviews are used as supporting data towards the outcome of the quantitative instruments from statistical analysis and it will reflect the students' personal feeling and view.

8. Conclusion

In this paper, the reviews on the needs of occupational, safety and health training and causes of accidents among young workers have laid out the causal reaction of the unwanted occupational accidents recorded. In Malaysia itself, data have shown that almost a couple of billion ringgit have been spent on compensation for occupational accidents since 2006 while compensation is estimated to cost US1.36 trillion dollars worldwide in year 2002 (Hämäläinen, et al., 2006). Almost 20 to 30 percent of the total cost is related to accidents involving young workers and unrecorded or unreported cases have yet to be accounted for. The critical condition has developed a conscience among researchers to find and explore answers for lowering the number of cases of occupational accidents among young workers. Thus, the purpose of this paper is to explain the conceptual framework for developing and implementing effective and efficient safety training and education for the young adults. The main focus of the research is to develop intervention behaviour-based safety training programmes to change a young adult's behaviour while studying rather than in the working. Concurrently, standard safety training (safety education) can be proposed to increase a person's knowledge on safety as the second factor in safety triad culture. Aside from these training methods, a traditional method is suggested as a control group and outcome of the comparison between these methods will identify if intervention training is effective and efficient as reviewed. Quasi-experimental research with non-equivalent control group design is proposed to be used as the quantitative method, and interviews were a part of the qualitative method. Other goal of this research is to determine the capabilities of cognitive in changing a person's attitude towards safety in type of training conducted. In terms of determining the changes in safety behaviour, a number of them are the independent factors of the TPB; which are self-efficacy, behaviour beliefs and normative beliefs. The theory of planned behaviour will be used to determine the effects of the factors on safety behaviour changes. The strength of predicting behavioural change in TPB has been shown in numerous applications but yet untested among young adults in safety laboratories application at tertiary Institutions. From the results of this research, we will be able to identify which of the factors and types of training need to be taught to future engineering students to obtain the most effective positive behaviour changes on safety practices among polytechnic engineering students.

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Table 6.1 Proposed Research Design (Explanatory mixed method design) Pre-test Post-Test Delayed Post-Test Non-Equivalent Control Group Design with interview

Group	Intact Classes	Pre-test	Experimental Variable	Post-test and Interview	Industrial Exposure	Delayed Post-test and Interview
G1 G4 G7	40* x 3	O1	New Programme 1	O2		O7
G2 G5 G8	40* x 3	O3	New Programme 2	O4		O8
G3 G6 G9	40* x 3	O5	Traditional	O6		O9
			Semester 3		Semester 4	

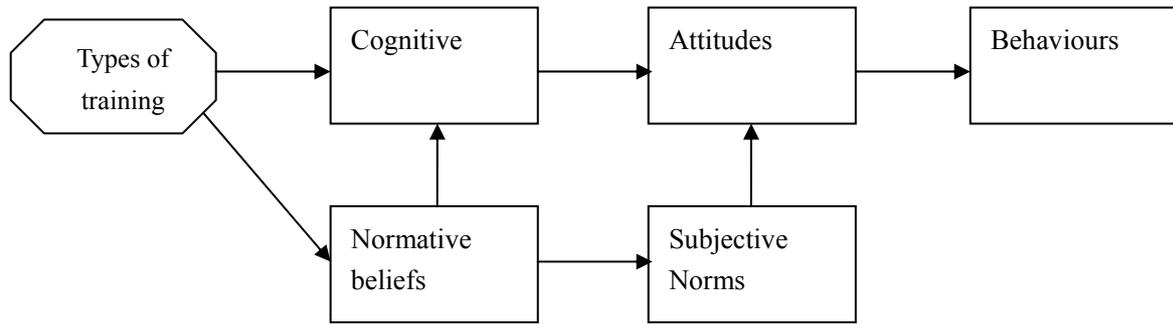


Figure 7.1 Safety and Health Training Model adapted from (Hong, et al., 2004)

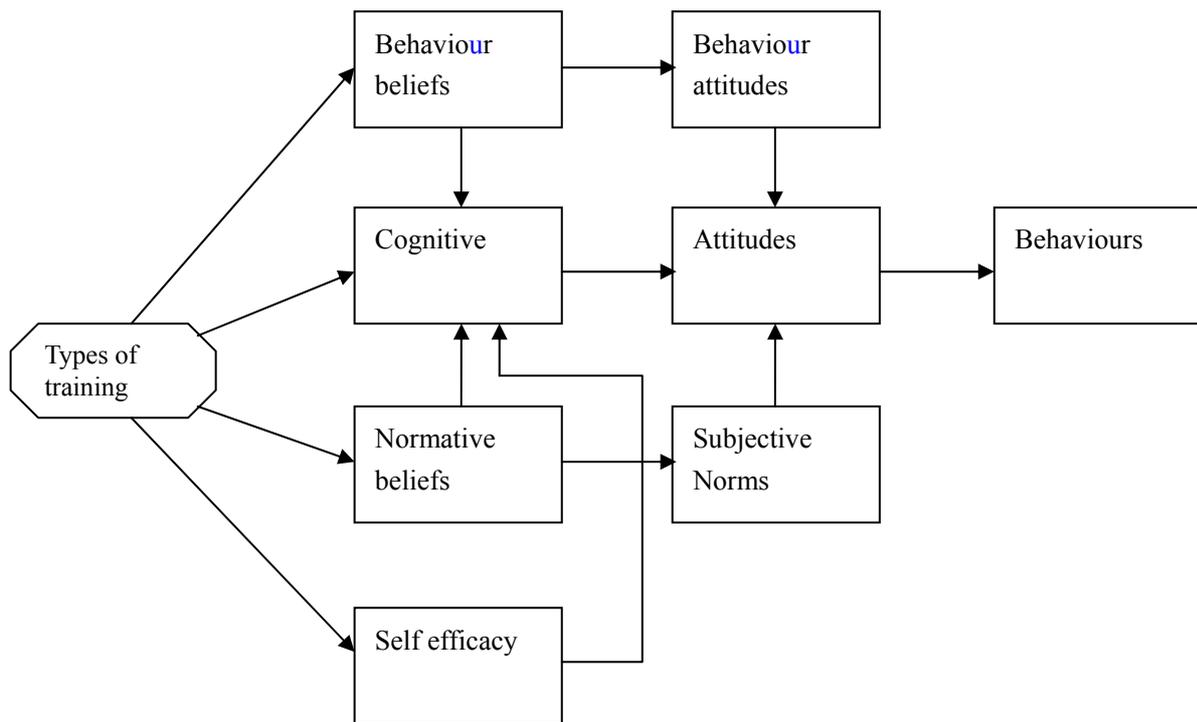


Figure 7.2 Proposed theoretical Framework