A STUDY OF THE RESULT OF TARGET BEHAVIOR CHANGE BY APPLIED BEHAVIOR BASED SAFETY AND PROTECTION MOTIVATION THEORY

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ABSTRACT

The purpose of this study was to investigate the results of the safety behavioral change process between the Behavior Based Safety (BBS) and the Protection Motivation Theory (PMT) techniques. The subjects were the workers in the polishing department of a factory in Pathumthani province. The participants in this program were divided into two groups, including 10 workers in the BBS group and 10 workers in the PMT group. The study began with the identification of at-risk behaviors and three target safety behaviors were selected according to the prioritized setting. The BBS and the PMT techniques were implemented for 12 weeks. Samples of the participants' safety behaviors were observed and recorded by the participants themselves. In addition, the assessment of knowledge, attitudes and behaviors regarding to safety at work of both target groups were collected by using self-administered questionnaire.

The results showed that the workers in the BBS and the PMT target groups developed increased target safety behaviors compared to before the study from 88.89% to 100% and 92.59% to 98.17%, respectively, at the end of the study. The target safety behaviors before and after the experiment within the BBS group and the PMT group were different significantly ($p=0.039$) and ($p=0.021$), respectively. In contrast, the target safety behaviors before and after the experiment between the BBS and the PMT groups were not different significantly ($p=0.634$). The assessment results from the questionnaire were found that knowledge, attitudes and behaviors regarding safety at work of the BBS and the PMT target groups increased from before the study.

In summary, it was found that both the BBS and the PMT techniques were able to change the safety behaviors of the workers and the results of both techniques were not significantly different. Nonetheless, the PMT technique can be applied using with workers who have less safety skills to those who are skillful. However, the BBS was more effective than PMT when applied to the workers who have already been good in terms of safety skills and the BBS is likely to take shorter time for workers' behavioral change than the PMT technique.

KEY WORDS: SAFETY BEHAVIOR / AT-RISK BEHAVIOR / BEHAVIOR BASED SAFETY / PROTECTIONMOTIVATION THEORY

100 pages

การศึกษาผลของการปรับเปลี่ยนพฤติกรรมเป้าหมายด้วยวิธีการปรับเปลี่ยนพฤติกรรมเพื่อความปลอดภัย และทฤษฎีแรงจูงใจเพื่อการป้องกัน

A STUDY OF THE RESULT OF TARGET BEHAVIOR CHANGE BY APPLIED BEHAVIOR BASED SAFETY AND PROTECTION MOTIVATION THEORY

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาผลของกระบวนการปรับเปลี่ยนพฤติกรรมความปลอดภัยระหว่างเทคนิค Behavior Based Safety (BBS) และเทคนิค Protection Motivation Theory (PMT) ของพนักงานแผนกขัดในโรงงานอุตสาหกรรมแห่งหนึ่ง ซึ่งทำการแบ่งกลุ่มตัวอย่างออกเป็น 2 กลุ่ม ได้แก่ กลุ่มตัวอย่างที่ใช้เทคนิคBBS จำนวน 10 คน และกลุ่มตัวอย่างที่ใช้เทคนิคPMT จำนวน 10 คน โดยเริ่มการศึกษาด้วยการบ่งชี้พฤติกรรมเสี่ยงและคัดเลือกไปเป็นพฤติกรรมความปลอดภัยเป้าหมายจำนวน 3 พฤติกรรมจากการจัดลำดับความสำคัญ เพื่อใช้ในการปรับเปลี่ยนพฤติกรรม เป็นระยะเวลา 12 สัปดาห์ โดยให้กลุ่มตัวอย่างสังเกตและบันทึกพฤติกรรมความปลอดภัยเป้าหมายของกันและกันเอง และได้ประเมินความรู้ ทัศนคติ และพฤติกรรมความปลอดภัยในการทำงาน ก่อนและหลังการทดลองของกลุ่มตัวอย่างทั้ง 2 กลุ่มด้วยแบบสอบถาม

ผลการศึกษาพบว่า กลุ่มตัวอย่าง BBS มีเปอร์เซ็นต์พฤติกรรมความปลอดภัยเป้าหมายเพิ่มขึ้นจากร้อยละ 88.89 เป็นร้อยละ 100 โดยมีพฤติกรรมความปลอดภัยเป้าหมายก่อนและหลังการทดลองแตกต่างกันอย่างมีนัยสำคัญที่ระดับความเชื่อมั่น 95% (p=0.039) และกลุ่มตัวอย่าง PMT มีเปอร์เซ็นต์พฤติกรรมความปลอดภัยเป้าหมายเพิ่มขึ้นจากร้อยละ 92.59 เป็นร้อยละ 98.17 โดยมีพฤติกรรมความปลอดภัยเป้าหมายก่อนและหลังการทดลองแตกต่างกันอย่างมีนัยสำคัญที่ระดับความเชื่อมั่น 95% (p=0.021) และเมื่อเปรียบเทียบผลการศึกษาระหว่างกลุ่มตัวอย่าง BBS และกลุ่มตัวอย่าง PMT พบว่ากลุ่มตัวอย่างทั้งสองกลุ่มมีพฤติกรรมความปลอดภัยเป้าหมายก่อนและหลังการทดลองไม่แตกต่างกันอย่างมีนัยสำคัญที่ระดับความเชื่อมั่น 95% (p=0.634) ผลการประเมินจากแบบสอบถาม พบว่า กลุ่มตัวอย่าง BBS และกลุ่มตัวอย่าง PMT มีความรู้ ทัศนคติ และพฤติกรรมเกี่ยวกับความปลอดภัยในการทำงานเพิ่มมากขึ้นกว่าก่อนการทดลอง

การศึกษาครั้งนี้สรุปได้ว่า กระบวนการปรับเปลี่ยนพฤติกรรมด้วยเทคนิค BBS และ PMT สามารถปรับเปลี่ยนพฤติกรรมความปลอดภัยในการทำงานของพนักงานได้ และให้ผลการปรับเปลี่ยนพฤติกรรมไม่ต่างกัน แต่อย่างไรก็ตามเทคนิค PMT สามารถนำไปประยุกต์ใช้กับพนักงานได้ตั้งแต่ผู้ที่มีพื้นฐานทักษะความปลอดภัยน้อยไปจนถึงผู้ที่มีทักษะมาก ในขณะที่เทคนิค BBS จะให้ประสิทธิผลมากกว่าเมื่อนำไปใช้กับพนักงานที่มีทักษะความปลอดภัยดีอยู่แล้วพอสมควร และมีแนวโน้มสามารถใช้เวลาในการเปลี่ยนพฤติกรรมได้สั้นกว่าเทคนิค PMT

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CHAPTER I
INTRODUCTION

1.1 Background and Rationale

At present, Thailand's economy has grown and more strong which leads to the improving and expanding of industrial sector and technology development. As a result of the expansion, it impels the employees hiring rate feeding to the producing process of industries and creates the business competition increasing at the same time. Furthermore, the entrepreneurs and businessman have to import modern technology from foreign country in order to improve product quality and respond customer demands. However, using industrial high technology, the mechanic requires highly level of operating skills, knowledge and worker's experience; as the specific machine has more complicate functions and may have various limited uses for domestic workers.

It may be the cause of occupational accidents and injuries. The occupational accidents are generating both valuable and invaluable losses, for instance: human resource, property, equipment, operation time, medical expense and image of the organization. Therefore, an establishment or an organization should be recognize and give precedence to workers security in the first priority. In consideration of reducing and preventing accidents in the workplace and other losses that may be occurs from work and to promote safety at workplace. The organization should be establish the safety management system and monitoring periodically to insure that all the workers comply the regulation correctly.

According to the number of workers who were covered by Workmen's Compensation Fund in 2012, there were 8,575,398 of total workers, in which 131,825 workers got injures or sicknesses from their work. The number of injured workers increased approximately 1.69% of the total injured workers in 2011. In other words, the statistic mentioned that the number of injured workers increased and they are more likely to suffer harm from work increased steadily each year. (1)

Although, the precise cause of occupational accidents and injury have not been analyzed clearly. Comparing statistic of accident with previous studies and Heinrich's Theories of Accident Causation (2) found that the major cause of accidents and fatal injuries of 116,006 workers were generated by unsafe acts. In additional, other 15,819 workers were suffered from other causes, occurring from unsafe conditions and unavoidable situation or act of god, for instance: natural disasters, lightning, floods, and earthquakes. The numbers of injured workers from the occupational accidents were shown in Table 1.1.

Table 1.1 The numbers of injured workers from the occupational accidents report in 2008 – 2012

Years	Number of workers					
	Death	**Disables**	**Partial dismember-ment**	**More than 3 workdays loss**	**less than 3 workdays loss**	**Total workers**
	Number (people)	**Number (people)**	**Number (people)**	**Number (people)**	**Number (people)**	**Number (people)**
2008	613	15	3096	45719	127059	176502
2009	597	8	2383	39850	106598	149436
2010	619	11	2149	39919	103813	146511
2011	590	4	1630	35709	91699	129632
2012	717	19	1818	36166	93106	131825
5 years average	628	12	2216	39473	104455	146782

By considering the severity of the injury are as follows: The five years average of the table indicated that most workers got injured and stopped working less than 3 days around 71.16 percent comparing with the total workers (104,455 people). Workers, who were fatally injured, died higher than being disabled, which is 0.43 per

0.00 percent (628 per 12 people). Therefore, concerning the occupational safety should be an important issue in order to avoid the possibility of loss.

According to the summary report of industrial accident and incident in 2008 – 2012 (3) the result shown that the main cause making workers got injured are unsafe acts of themselves.

From the above report, the common cause of unsafe acts are initiated by low or lack of safety awareness or carelessness of workers and working with rush attributable to overconfidence in their experience. Most workers think they are familiar with their routine job and have the expertise in their works. The accident which occur cause by unsafe acts such as a previous accident case in the resin and leg assembly machine in electronic industry which located in Lamphun province, the worker's finger is pressed by the machine due to their carelessness during work. The next accident case is a fire accident in foam and sponge industry which located in Phranakorn Si Ayutthaya province also was caused by the carelessness of their worker who smoking during works. As a result, fire burning at the warehouse, for foam, sponge and mattress material and damaged to whole factory areas. (The summary report of incident and accident investigation in industry year 2009, 2011)

Furthermore, the above reason the avoidance of work safety rule and regulation, avoidance of standard working procedure and neglecting to wear personal protective equipment while working in a hazardous area due to their belief that accident has low probability to occur or they have never been hurt before while doing their job in an unsafe way. Nevertheless, they are not taking into consideration that an accident victim was the person who make a mistake just once and it consequence impact is more severe. These activities can cause health and safety impacts to the workers and also cause of occupational accident. For instance, an accident case of the gas leakage at natural and synthetic fiber industry which located in Saraburi province was cause by the neglecting to wearing gas mask of the workers during the investigation of hydrogen sulfide and carbon disulfide gas leakage sources in distillation tower after gas detector initiated the alarm. As a result, the workers inhale the toxic gases. (The summary report of incident and accident investigation in industry year 2009)

Therefore, the researcher is interested in the study of unsafe acts of the workers which are the main cause of occupational accidents and injury by apply the Behavior Based Safety (BBS) which is the behavioral change process that most commonly use in the workplace safety aspect and the Protection Motivation Theory (PMT) which is the behavioral change process that most commonly use to change in health behaviors in the public health aspect and commencing on the research study to apply for the safety behaviors change, in order to create the concerning of safety awareness and recognizes the importance of working safely among the workers.

1.2 Research Question

Does the implementation of the BBS and the PMT programs change worker's safety behaviors?

1.3 Objective

1.3.1 General Objective

To study the results of the changes in target safety behaviors through the Behavior Based Safety (BBS) and the Protection Motivation Theory (PMT) techniques implementation.

1.3.2 Specific objectives

1.3.2.1 To study the knowledge, attitudes and behaviors regarding safety at work levels change before and after applied the Behavior Based Safety technique.

1.3.2.2 To study the knowledge, attitudes and behaviors regarding safety at work levels change before and after applied the Protection Motivation Theory technique.

1.3.2.3 To compare the results of the changes in target safety behaviors before and after applied the behavioral change process between the Behavior Based Safety and the Protection Motivation Theory techniques.

1.3.2.4 To evaluate the satisfaction of the workers after the Behavior Based Safety and the Protection Motivation Theory techniques implementation.

1.4 Hypothesis

1.4.1 The target safety behaviors of the workers before and after the behavioral change through the Behavior Based Safety technique are different.

1.4.2 The target safety behaviors of the workers before and after the behavioral change through the Protection Motivation Theory technique are different.

1.4.3 The Behavior Based Safety technique and the Protection Motivation Theory technique yield different effects in target safety behaviors of the workers change.

1.5 Variables

1.5.1 Independent Variables

1) Behavior Based Safety intervention
2) Protection Motivation Theory intervention

1.5.2 Control Variables

1) Work experience
2) Work characteristic
3) Work position

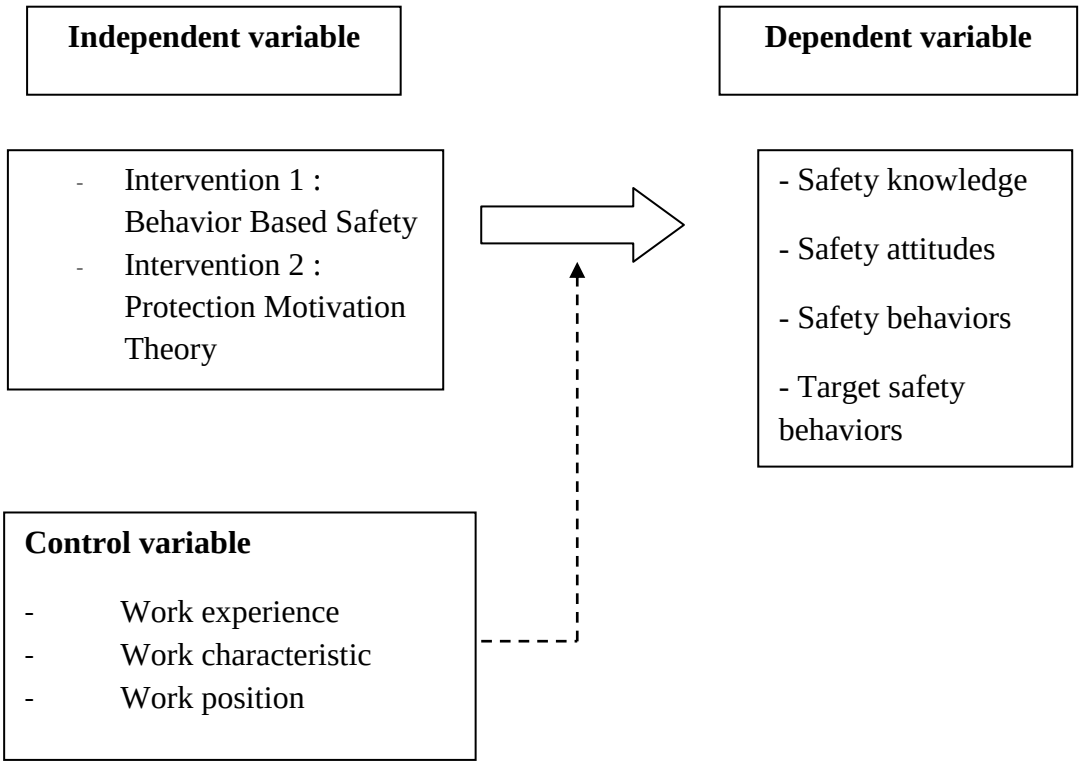
1.5.3 Dependent Variables

1) Safety Knowledge
2) Safety Attitudes
3) Safety Behaviors

1.6 Scope of the study

This study is the application of the Behavior Based Safety and the Protection Motivation Theory techniques to modify the safety behaviors of the polishing workers in a factory.

1.7 Conceptual Framework



1.8 Glossary of Terms and Definitions

1.8.1 Target safety behavior: refers to the behavior of the workers that work with full concern of safety. For instance, wearing the personal protection equipment, wearing safe or appropriate outfits, follow the standard of operation, inviolate the safety rules, not use defective equipments, proper use of equipments with

their intended purpose, etc. The evaluation of target safety behavior of the workers will be indicated by behaviors observation form.

1.8.2 At-risk behavior: refers to actions or aspects of work, which tend to generate risk. For instance, failure to use personal protective equipment, taking shortcuts, making safety devices inoperable, ignoring safety procedures, run or play with each other during work, wearing unsafe outfits, using defective equipment, use of tools for other than their intended purpose, and violate safety rules, etc.

1.8.3 Behavior Based Safety: refers to the process of behavior adjustment, especially to empower a concern of safety in the workplace. The procedure begins from identify of at-risk behaviors, then solve and improve the unsuitable behaviors of the workers in order to the workers able to working more safely.

1.8.4 Protection Motivation Theory: refers to the process of behavior modification. By stimulating perceive of safety awareness of the workers through given information until they have the ability to evaluate the severity of at-risks behavior in order to create an incentive of workers to work with safety.

1.8.5 Safety shoes: or steel-toe boot, steel-capped boot are a durable boot or shoes that has a protective reinforcement in the toe which protects the foot from falling objects or compression, usually combined with a mild sole plate to protect against punctures from below.

CHAPTER II
LITERATURE REVIEW

The purpose of this study is to promote safety behaviors in the workplace of the polishing workers in a factory. The study comprises of the majors concept, theories and related studied as the following:

- Conceptual and theories of accident
- Conceptual and theories of behavioral science
- Conceptual of attitude
- Conceptual of knowledge
- Conceptual and theories of behavioral change process
- Literature cited

2.1 Conceptual and theories of accident

2.1.1 Definition of accident

Accident has many different meanings according to the definition given as follows.

Vitoon and Verapong (2008) defines that accident is an incident that occurred without planning ahead which caused of the injury, disability or death involving to the property has been damaged. (4)

Vichai (2012) defines that accident is an incident occurred by chance, unexpected, unplanned which occurs suddenly and can cause injury, loss, disability and death involving loss of property. (5)

National Safety Council: NCS defines that accident is an unplanned, undesired event which if it occurs, it will not just injure or property damage only but the situation also affected achievement.

British Standard Institution: BSI defines that accident is an undesired event which led to death, illness, loss of property and others loss.

Thai Industrial Standards Institute defines “accident” in the Occupational health and safety management system standards or OHSAS 18001: 1999. Accident is an undesired, unplanned, unexpected or lack of control event which cause of injury, illness from work, death, loss of property, workplace environment damaged and have an effect to the public.

From the above definition, it can be concluded that an accident means an undesired, unplanned, unexpected and lack of control event which cause injury, illness, death, loss or damaged of property, workplace environment and public. (6)

2.1.2 Causes of Accident (4)

In 1920 H.W. Heinrich studied the reports of 75,000 industrial accidents. The studied can be concluded the causes of accident as following.

2.1.2.1 Eighty-eight percent of industrial accidents are caused by human causes or unsafe acts committed by fellow workers.

2.1.2.2 Ten percent of industrial accidents are caused by mechanical failure or unsafe conditions.

2.1.2.3 Two percent of industrial accidents are caused by acts of God or unavoidable cause such as storm, earthquake and flood.

From the research studied, H.W. Heinrich published “Industrial Accident Prevention” in 1931 which was last accident prevention conceptual revolution and safe promotion in factory. He concluded the important of accident causation into two causes as follows.

1) Unsafe acts: performance of a task or other activity that is conducted in a manner that may threaten the health and safety of workers, approximately 85 percent of all accidents are triggered by unsafe acts. For example:

- Operating without qualification or authorization.
- Working in hazardous locations without adequate protection or warning.
- Carelessness
- Contravene the workplace safety regulation.

- Lack of or improper use of personal protective equipment
- Wearing unsafe clothing.
- Bypass or removal of safety devices and safety guard.
- Use of tools for other than their intended purpose.
- Play or tease each other during working.

2) Unsafe conditions: A physical condition in the workplace that is likely to cause property damage or injury, approximately 15 percent of all accidents are triggered by unsafe conditions. For example:

- Inadequate supports or guards.
- Poor ventilation, excessive noise, very high or low temperature.
- Poor housekeeping such as slippery floor and improper storage.
- Lack of workplace environment management.
- Hazardous atmospheric conditions.
- Defective tools, equipment or supplies.
- Inadequate warning systems.

2.1.3 Domino Theory (7)

The main concept of domino theory is injury and damage that the result of accident which is the result from unsafe acts. There are five factors in the sequence of events leading up to an accident. These factors can be summarized as follows.

2.1.3.1 Ancestry and Social Environment. Negative character traits that may lead people to behave in an unsafe manner can be inherited or acquired as a result of the social environment.

2.1.3.2 Fault of Person. Negative character traits, whether inherited or acquired, are why people behave in an unsafe manner and why hazardous conditions exist.

2.1.3.3 Unsafe Act/Mechanical or Physical Hazard. Unsafe acts committed by people and mechanical or physical hazards are the direct causes of accidents.

2.1.3.4 Accident. Typically, accidents that result in injury are caused by falling or being hit by moving objects.

2.1.3.5 Injury. Typical injuries resulting from accident include burning, sprains, lacerations and fractures.

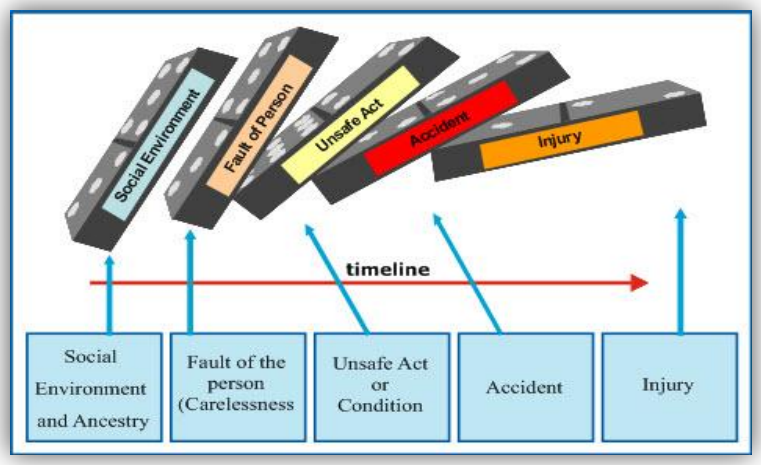


Figure 2.1 Domino Theory

Domino theory has two central points: first, injuries are caused by the action of preceding factor and second, removal of the central factor (unsafe act/hazardous condition) negates the action of the preceding factors and, in so doing, prevents accidents and injuries.

2.1.4 U.S. Army accident Theory (8)

The safety management of U.S. army was developed by using a new technology to protection. They studied the safety technology coupled with manufacturing technology. This theory concluded the causes of accident are as follows.

2.1.4.1 Human Error: are the unsafe acts of worker or unsafe conditions that present on workplace. An error that occurs is the result of human acts or lack of adequate training and motivation to work.

2.1.4.2 System Error: caused by inappropriate designed which cause of inappropriate policy such as saving, technology selected, maintenance and failure by design.

2.1.4.3 Management Error: main cause is from inappropriate information, technologies and system management. This failure caused by incorrect communication, inadequate training and lack of motivation to work.

2.1.5 Firenze System Model (8)

Bob Firenze explained the concept of safety system that is the study cause of accident should be study the component of whole system which interaction with each others. The component in this model which is important to the decision making to task and accident occurs including man, machine and environment.

2.1.5.1 Man: as for the production in each piece, workers have to decide only one method for achieving the purpose. The each decision to achieve the goal has risks lurking anywhere, so workers need to have enough news. If the news is good, the decision will correct but if the news is not correct, the decision will mistake or will have more risks and will cause failure of the operation which may result in an accident.

2.1.5.2 Machine: Equipment and machine that used in production should be readies for working without any error. If equipment and machine design were not appropriated or lack of good maintenance, it would make the machine operating error which can lead to the accident.

2.1.5.3 Environment: workplace environment have an important role to production. The environment error that occur affect workers and machine as the cause of accident such as working with chemical dust and glare environment. Therefore, before make a decision worker should be searching and collect the information for ensure that these decision making is correct. By consider the information about work characteristics and nature of harmful consequence that may occur. If we have quality information, it can be help to reduce risk and uncontrollable situation. So, the opportunity of an error and accident that maybe occurs will be reduce.

From the above reason, should be giving the essential and beneficial information to workers such as training and work practice suggestion. For make the highest work effective and reduce the decision error of worker.

2.1.6 The Human Factor Theory (7)

The human factor theory attributes accidents to a chain of events ultimately caused by human error. It consists of the following three broad factors that lead to human error are as follows.

2.1.6.1 Overload: are amounts to an imbalance between a person's capacity at given time and the load that person is carrying in a given state. A person's capacity is the product of such factors as his or her natural ability, training, state of mind, fatigue, stress, and physical condition. The load that a person is carrying consists of tasks for which he or she is responsible and added burdens resulting from environmental factors (noise, temperature and other distractions), internal factors (personal problems, emotional stress, and worry), and situational factors (level of risk, unclear instructions). The state in which a person is acting is the product of his or her motivational and arousal levels.

2.1.6.2 Inappropriate Response: is how a person responds in a given situation can cause or prevent an accident. If a person detects a hazardous condition but does nothing to correct it, he or she has responded in-appropriately. If a person removes a safeguard from a machine in an effort to increase out-put, he or she has responded inappropriately. If a person disregards an established safety procedure, he or she has responded inappropriately. Such responses can lead to accidents. In addition to inappropriate responses, this component includes workstation incompatibility. The incompatibility of a person's work station with regard to size, force, reach, feel, and similar factors can lead to accidents and injuries.

2.1.6.3 Inappropriate Activities: is Human error can be the result of inappropriate activities. An example of an inappropriate activity is a person who undertakes a task that he or she doesn't know how to do. Another example is a person who misjudges the degree of risk involved in a given task and proceeds based on that misjudgment. Such inappropriate activities can lead to accidents and injuries.

When studied the accident causation theory from above, we can conclude the main cause of accident are caused by unsafe acts. Therefore, unsafe acts are the main point to solving workplace safety problem. If workers safely work and gained adequately training, they can be protect themselves and their colleagues from any hazardous work and able to maintain safety at work.

2.1.7 Loss of occupational accident (5,6)

Each of accident that occurs has an effect on worker, family of worker, colleague, employer and country as following.

2.1.7.1 An effect on worker such as injury, disability, death, loss of self-confident and loss of income which paid for treatment and rehabilitation cost.

2.1.7.2 An effect on worker's family is loss of income. In case of worker who were injured to be disability or death, their family have to look after them and despond.

2.1.7.3 An effect on colleague such as partner loss of working time as they need to help casualty and despond. Chief or commander wastes time to investigate the cause of the accident, wastes time to prepare reports and wastes time to provide other worker for training to work on behalf of the injured.

2.1.7.4 An effect on employer such as loss of money which paid for treatment cost, funeral expenses, repaired cost for machine, equipment and material that was damaged from accidents. The opportunity was lost to make profit and factory image as the result of the manufacturing process interruption.

2.1.7.5 An effect on country such as loss of funding to pay the compensation and allowances, loss of human resources and loss of reputation and image of the country which caused the economic and social issues.

When consider the losses and the impacts that occur from the accident. We can be classified the loss of accident into two categories: direct loss and indirect loss. The indirect loss is more damage than the direct loss. However, many people are not usually thinking about it. Hence, had the comparison loss with cost of accident likes "iceberg". The outcrops can be seen, only slightly compared to the submerged. In the other hand, direct costs that are recoverable are visible but indirect costs that are unrecoverable are hidden below the waterline. Therefore, indirect cost is the hidden loss which entrepreneur should not disregard.

2.2 Conceptual and theories of behavioral science

2.2.1 Definition of behavior (9)

Behavior is an observable reaction of a person to something, or a situation. Behavior could be seen, heard, and could be repeatedly indicated by objective tool, both internal and external of the body.

2.2.2 Types of behavior (9)

Behavior could be classified into 2 types, including;

2.2.2.1 Overt Behavior: is an action, which observable by others through the five senses (vision, hearing, smell, taste, and touch) includes:

- Directly observable behavior: does not require tools in observation, also known as Molar Behavior; for instance, laugh, cry, mouth opening, and jumping.

- Unobservable behavior: could not be observed without tools, also known as Molecular Behavior; for instance, beats of heart, and blood pressure.

2.2.2.2 Covert Behavior: refers to the internal action of a person, which could react under full consciousness, or under unconsciousness. Normally, these behaviors are not observable by others, unless being told, or act until observable.

Therefore, covert behavior is a private experience: only a person could feel; for instance, thoughts, memories, imaginations, dreams and feelings such as fear, sadness, hunger, pain, etc. Even though covert behavior could not be directly observed, it could be observed indirectly utilizing tools, such as questionnaires, as well as observing overt behavior that may related to covert behavior. Covert behavior could be classified into two categories;

- Conscious Processes: such as hunger, tiredness, excitement, and pain for examples. These behaviors are known by a person when happened, and could be controlled to hide the signs of behavior.

- Unconscious Processes: some behaviors could occur intra-personally when a person is unconscious, yet affected on their overt behavior; for examples, cowardice, courage, ideas, expectations, desires and pleasures.

2.2.3 Elements of behavior (9)

Behavior is a result of the selection of the most appropriate reaction to the stimulation in the different situation. L.J. Cronbach (1963) stated that human behavior consists of seven elements include:

1) Goal: is an objective, or need that creates behavior, such as need of social fame, need of success, etc.

2) Readiness: is a level of maturity and abilities required in an action to satisfy needs.

3) Situation: is a way, or occurrence that creates opportunity to satisfy needs.

4) Interpretation: is an argument to the process or situation, in order to find the most preferable method to satisfy needs.

5) Response: is a process of following selected activity.

6) Consequence: is a result from the action taken, which could be both as expected or the opposite.

7) Reaction to Thwarting: is a reaction when the result of action failed to satisfy the needs; hence, the new interpretation process is required in order to find the way to fulfill needs. However, the goal may be discarded if the interpretation finally found that it is impossible. A behavior will be completed and ended when the sequence is matched with the expectation. If the expectations are not met, humans would continuously response and react to the consequence.

2.2.4 Behavior Formation Process (9)

It is a fact that a behavior of a person has been created in a systematic process. Behavior creation process could be divided into three sub-processes include:

1) Perception Process: is a primary process, started when a person received senses, or information of the stimulator through the sensation.

2) Cognition Process: known as a process of intelligence, consists of learning, thinking, remembering, as well as implementing, or development of the knowledge through the exposure. The sensational exposure that could lead to thought and knowledge creation is operated under complex mind system.

3) Behavior Process: after the process of recognition, thinking, and understanding, a person may have emotions in response to the situation, yet does not show any expression and remain it as covert behavior. Then, after thinking and the action is selected in response to the situation, it will be shown as overt behavior.

These three processes could not happen individually; each time a behavior is created, all of the processes are continuous and highly related to others. Every behavior is a result of response to stimulus of a person. Some responses respond directly to the stimulus, such as crying when feel a pain, and eating when hungry. Nonetheless, sometimes a person does not respond directly to the stimulus. Therefore, a study of human behavior is very complex.

2.2.5 Behavioral evaluation (10)

2.2.5.1 Direct methods of behavioral study could be categorized into two methods include:

- Direct Observation: is an observation of behavior, where the observed person is informed by the observer. In this method, some of the observed persons could hide their behavior; for instance, a manager informs workers that their activities during work will be observed.

- Naturalistic Observation: is an observation of behavior, where the observed person does not aware of the observation, and the observer does not obligate their normal behavior. This method allows the observed person to show their real behavior. The limitation of this method is that it requires plenty of time to observe a target behavior, and requires observing repeatedly and continuously. Some behavior may take up to a year to observe.

In both methods of the observation, with or without awareness, the observer is required to be delicate and systematic; recording is required when the target behavior is observed. Moreover, an observer must eliminate all biases toward a person being observed, which allows the observation to be accurate and trustworthy.

2.2.5.2 Indirect methods of behavioral study could be categorized into three methods include:

1) Interview: is a method which a researcher requires to interview a person or a group to retrieve information. An interview could be face to

face, or could have a middle person to assist the interview, such as a translator when the interviewer and interviewee could not communicate effectively enough. The interview that aims to observe behavior can be divided into two types:

- Direct interview: the interviewer asks questions to the interviewee about the target behavioral topics.

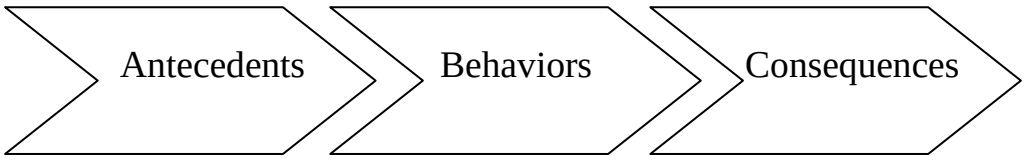
- Indirect interview or informal interview: the interviewee is not aware of what the interviewer needs. The interviewer will keep continuing a conversation and interpose the target question where possible. This method allows the interviewer to receive a lot of information; however, the limitation is that the interviewee does not want to reveal some information, which may prevent the interviewer to receive the real behavioral information.

2) Experiment: is a behavioral study, which an observed person is maintained in a condition required by an observer. In fact, controlled study environment could only be done in the laboratory; controlled environment of behavioral study in a society is nearly impossible. Laboratory experiments provide limited information, which could not always apply to real society. However, this method is very useful in behavioral study among medical workers.

3) Note: This method requires the observed person to record their behavior, which could be a diary, or certain behavior records, such as eating habits, working habits, and health behavior.

2.2.6 ABC Model (11)

The model that used to study the human behavior for explained that "why do people behave like that". ABC Model has three-term contingency are as following.



A = Antecedents

B = Behaviors

C = Consequences

1) Antecedents are what occurs before the behavior (and may have triggered it). The antecedents are simply all the relevant things that happened before the behavior occurred. They can also be considered as triggers for the behavior.

2) Behavior is what happens during the behavior (what does it look like?). Before you respond to an actual behavior, the key is to understand the purpose of the behavior and what it may be expressing about unmet needs. Although emotions can be running high, there are still strategies that can prove useful during the behavior itself.

3) Consequences are what are the immediate and delayed reactions from everyone involved? Consequences can be pleasant or unpleasant. A pleasant consequence will reinforce the behavior while a negative consequence will discourage a behavior. A consistent response from everyone to challenging behavior can have a very strong effect.

2.3 Conceptual of Attitude (12)

Attitude is a factor in determining human behavior, because attitude is related to perception, learning, emotion, personality and motivation. So attitude is a mental or neutral state of readiness, organized through experience, exerting a directive or dynamic upon the individual's response.

2.3.1 Definition of attitude

Behavioral sciences academicians have defined the word Attitude as follows.

Schermerhorn John R. defines that attitude is the tendency of individuals to feel, to respond positively or negatively and behave in a particular way towards some object.

Robbins Stephen P. Attitude is evaluation of favorable or unfavorable things related to event, objects, people, aim and shown individual sense toward something.

Attitude is evaluation of things. It is related to the feelings of the individual to the stimuli and the environment such as humans, animal, things, wordings, sign and other abstractions. The feeling could be positive or negative, for

example, like and dislike. So, it is evaluation of environment or stimuli of each individual.

The Summary of the Meaning of Attitude

Attitude is a person's point of view or way of looking at something, and gives him/her a tendency, readiness or predisposition to act or react in a particular way in a given situation. Attitude was gain from experience, recognition, feeling and expectation. These will affect thought inside human's mind and cause reaction and behavior, for example, gestures, words and actions. However, most of attitudes are related to behavior caused inside human's mind more than overt behavior.

2.3.2 Formation or source of Attitude

There are many source of individual because human attitude began to develop from childhood to adulthood. Therefore, source and cause of attitude can be determined as follows.

2.3.2.1 Family: everyone in family will influence the attitude of child born into that family a lot, since they are brought up, taught, loved, saved and taken care. Children will pay attention to behavior of people in their family, at the same time, patents educate them, children imitate behavior of their parents and parents implanted behavioral influence to their children. They will deeply believe because children in this age have their parents as a role model.

2.3.2.2 Friends: friends have a high influence in individual's attitude because friend is a source of opinion changing in many issues. Close friend is trustworthy. Influence of friend will affect children's attitude since they are adolescence. Teenagers will start going out more to meet their friends and build relationships with their peers, both in and outside of school. They want to join the group and be accepted by others, and then they accept opinions, practices and have same attitude with their friends.

2.3.2.3 Education: whether formal or informal, is important to establish the personal attitude, because each person takes a very long time to learn since they were children till teen. Humans have inherited knowledge, ideas and theories through educational system, activities, observation, training and self-study. These will affect elements of perception and elements of feeling or emotion. These

factors will be a foundation of personal attitude. However, teachers or instructor also affect the behavior and attitudes of children.

2.3.2.4 Information: nowadays, the information systems have become grown and more sophisticated. There is a lot of information and it is easy to access. Information is presented through many media channels and this information will influence people, especially the youth. They will gain knowledge to create attitudes and values. This may be a bad thing and not appropriate to their age, such as, attitude toward sexuality and drugs. This may cause social problems. It's shown that media have an influence in individual's attitude.

2.3.2.5 Culture and tradition: human beings are social animals as they are member of that society. They must behave according to the rules of the society. Each society has its culture and traditional that social's membership has to obey and compliance. Otherwise, they may be punished or not accepted by the society itself. Therefore, humans need to learn and accept the cultural and traditions of the society in which they live. Cultural, traditions and values will build and develop attitudes of individuals within the framework of the culture of the society and be accepted in the society.

2.3.2.6 Personal experience: experience will also influence the attitude of the person. Whether bad or good experience could affect attitude building, for example, we bought something but it was bad and poor quality, we will have bad attitude toward that product. Therefore, personal experience is also one of the factors influence building of personal attitude.

2.3.3 Changing Attitudes

Changing attitudes can be done as follows.

2.3.3.1 Communication: provides accurate information to employees. If an organization has effective communicate, it can help supervisors build relationships and understanding with their subordinates. So communication is a way to help employee create or change attitudes in the direction that the organization needs.

2.3.3.2 Additional Information: sometimes information provided to employees is not enough, there are some more additional information.

Therefore, additional information is important, because it can help employees understand situation more clearly. At the same time, if employees don't have enough information, it could make them confused about that situation.

2.3.3.3 Reinforce Desired Attitudes Change: has two methods as follows.

- Reward: is the expresses and recognition for support good behavior and attitude of the organization desire such as give reward or certificate and bonus to the best employee.

- Punishment: employee whose behavior or attitude toward the organization is not desirable. Organizations may be appropriate punishment for those employee behavior change and improved attitudes toward the organization desire such as parole, reduce wages and bonus.

2.3.3.4 Utilization of Group Influence: executive may use group influence to change the behavior or poor attitude of some employee in the group by trying to reach the leader and members of the group to put pressure on some employees who have incorrect attitudes to stop that unwanted behavior by the pressure of the group.

2.4 Conceptual of Knowledge

2.4.1 Definition of knowledge (13)

The royal institute dictionary has defined the word knowledge as thing gain from study, education or experience, including the ability and practical skills; understanding or information derived from experience; thing has been heard of the idea or practice; the subjects in their field such as knowledge about Thailand, knowledge of health.

2.4.2 Type of Knowledge (14)

The interesting and popular concept of an assortment of knowledge of Michel Polanyi and Ikujiro Nonaka divides knowledge into two categories.

1) Explicit Knowledge: is knowledge that can be collected through various methods, such as writing, theory and manuals. Sometimes referred to concrete knowledge. The management of this type of knowledge is focused on access to knowledge, ability to detect and interpret them. When it applied to the new knowledge, it will be noted for future reference or for others to access it.

2) Tacit Knowledge: is knowledge gained from the experience, talent or instinctive of individual in understanding of things. . This knowledge cannot easily convey into words or in writing, such as job skills, craft and critical thinking skills. Tacit knowledge management is focused on arrangement for the sharing of knowledge of performers. It causes a collaborative learning that led to the creation of new knowledge that each can be used to perform in the future.

2.4.3 Knowledge Assessment (15)

There are many tools for knowledge assessment. Each tool is suitable to different characteristics of knowledge, but the most popular tool is questionnaire, the writing tool. Questionnaire is divided into two types.

1) Essay Type/ Subject Test are a questionnaire that requires writing answer or writing an item as appropriate.

2) Objective Test is a questionnaire that provides answers and participants have to choose the best answer which has 5 types as following:

- Supply or Completion Type
- True- False
- Selection Type
- Matching
- Multiple Choice

2.5 Conceptual and theories of behavioral change process.

2.5.1 Observation Learning (16)

Observation learning is a basic idea of social cognitive theory that developed by Canadian psychologist, Albert Bandura. This theory has an influence in

development of social cognitive theory. Bandura believed that most people learned from the observation of the modeling. It was different from learning from experience that required trial and error, besides the loss of time; it could be dangerous in certain behaviors. To learn through modeling, one modeling can convey the idea and expression simultaneously. As people live each day in a narrow environment, recognition about the condition of society comes from the experience of others by hearing and seeing without direct experience. Most people perceive mostly about their society from media.

Fischer & Gochros(1975) and Ross(1981) summarize the roles of the model into three aspects as follows.

1) Generate new behavior: the observer has never learned such a behavior, for example, speaking behavior of children or behavior of self-help skill.

2) Enhance existing behavior: the observer has never learned some of such a behavior in the past. The model will serve as a stimulus to those who have studied such behavior try to develop better. For example, watching world tennis tournament could be a motivation to be as good as some of the world tennis players. The observer will remember how the tennis player plays and then develop his tennis skill even further.

3) Inhibition of behavior: the observer has an undesired behavior or never has such a behavior. The model will help reduce or retain such unwanted behavior. For example, seeing people cross the road at a place that was not a crosswalk or overpass and then they die in a car crash, it will cause a person to restrain from such behavior.

Model is divided into 2 types as follows.

- Live Model is the model that individual has chance to observe and practice directly.

- Symbolic Model is the model that presented through media like radio, TV, cartoon or novel.

Bandura (1989) divided observation learning into 4 processes as follows:

A. Attention Process: individuals cannot learn a lot from observation, if they have no attention and cannot acquire accurately behavior of the model. Attention process determines whether a person will notice from the model. There are many

elements affected attention process including model itself, it's found that the model that make a person intends to observe must have a clear characteristic and be appreciated by the observer. His or her behavior is not complicated and useful. Not only the model but also the observer affected attention process. This element is composed of ability to perceive including seeing, hearing, tasting, smelling and touching; point of intellectual perception; arousal level and interesting in learning.

B. Retention Processes: individuals are not influenced much by the model, if they cannot remember characteristic of the model. They have to transform information to be a symbol and restructure to make it easier to remember. Factors affect retention processes are collection of code and make it as a symbol in order to make it easy to remember, structure of the intellectual, practice characteristic of the model in their mind and practice by doing. Moreover, retention process is based on cognitive ability and cognitive structure of the observer.

C. Production Processes: are the processes that the observers convert the symbol into action. Result of the action depends on what they can remember from their observation, the feedback from their actions and comparison of action and the images they can remember. Moreover, it depends on characteristic of the observers which are physical ability and skills in various sub-behaviors that they can behave as a model.

D. Motivation Processes: individuals who have learned and they will behave such behavior or not, depends on motivation process. Motivation processes depend on element of temptation from the outside. This temptation will raise awareness. It must be tangible and behavior that acts as the model can control events. It also depends on the temptation to see other people get something and their own temptation, which may be material and self-assessment. Besides, the term of observer, it also depends on the satisfaction of temptation, bias from social comparison and their own internal standards.

2.5.2 Protection Motivation Theory (17, 18)

Protection Motivation Theory was developed in 1975 by Ronald W. Rogers and then it was revised and adopted in 1983. This theory have comprised of Health Belief Model and Self-Efficacy Theory. In other words, it was a combination

of factors that contribute to the overall perception of the person which was linked to a change in attitude and behavior. This theory focuses on assessment of perception of information which evaluates perception from media that cause fear. Rogers has set three variables that cause fear for this assessment of perception included Noxiousness, Perceived Probability and Response Efficacy as shown in Figure 2.2

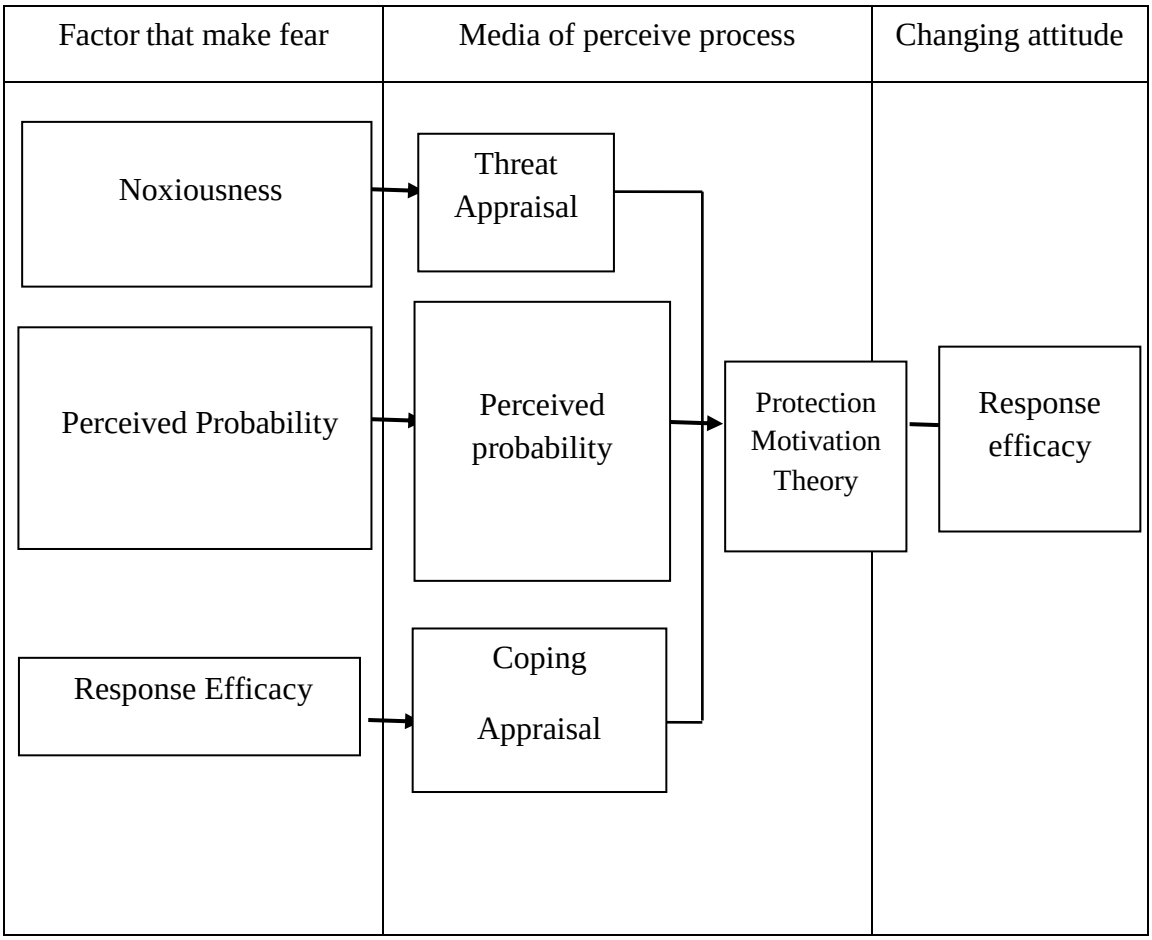


Figure 2.2 Original model of protection theory Rogers, 1975

After that, Maddux and Rogers (1983) have added the forth variable which was Self-Efficacy Expectancy. Detail of each variable provides as follows.

The First Variable: Noxiousness is from telling individuals that they could have been injured from behave or not behave some actions by using the media to disseminate information that threaten to health. Message or detail in this information might be a serious harm to health or fatal. In general, the information that causes higher fear will affect a person to change attitude more than information that

cause lower fear. Change in attitude and behaviors often used stimulating or exciting with threatening with the use of the media which will enable individuals to perceive severity of the disease than normal stimulation.

The Second Variable: Perceived Probability uses the dissemination of information to communicate to make people believe that they are at risk of developing the disease. The perception of risk of the disease is based on the decision of the individual. If they do not behave to avoid the disease, they will have a chance of disease and can be harmed by the disease. Recognition of risk of disease can be achieved as well as the perceived severity of the disease by using a test to assess the awareness and use of the media to raise awareness. For example, smokers read the article about smoking cause heart disease and lung cancer. This information will show the smokers that they have chance of heart disease and lung cancer.

However, those with a high risk for the disease might not always be willing to follow instructions in order to reduce the risk of disease. For example, after the smokers are encouraged to recognize, but they still behave the risk of disease and the smokers know that they have risk of lung cancer, but still refuse to acknowledge the risk by avoiding chest x-ray.

Therefore, to make people follow the recommendations will be done well must use the conditional risk of disease with the consequences of the implementation of the instructions. In other words, to make people aware that they have a high risk of disease, together with the advantage results of the practice or to avoid risky behavior will help them to increase willingness to change their behavior.

The Third Variable: Response Efficacy is a presentation of information in order to decrease risk of disease. In general, it was presented by modification or decreasing incorrect behavior and identifying advantage of the behavior modification and practice.

From the study of Maddux and Rogers (1983) found that telling the consequences of following the recommendations or the increasing expectations of the results will arise attention to stop behavior that causes risk of disease and will lead to attention of health protection which can reduce the severity of the disease.

The Fourth Variable: Self-Efficacy, as protection motivation theory was developed from health belief model and self efficacy theory of Bandura (1997) which

believed that psychological changes processes vary depending on their abilities and have many ways to do such as imitation, learning or teaching by saying. Therefore, self-efficacy can make behavior change at the highest level and it is a basic of making a person truly follow. Bandura explained that to make people follow the recommendations, the content of the information should be effective and can help people to practice.

The experiments that demonstrate the importance of expectations in their own ability using in the disease prevention by studied in the group of internal locus of control and the group of external locus of control, found that the group of internal locus of control believes that good health or illness arising from the performance of each person and this group seeks information for their practices of disease prevention. On the other hand, the group of external locus of control believes that their health is up to chance, destiny, fate and other powers. As a result, they have no intention of acquiring knowledge or practice for disease prevention. This indicated that the internal locus of control has higher self-efficacy than the external locus of control.

From the study of Beck and Lund (1981), the result shown that personal competencies is the most reliable predictive indicators for behavior changing of the sample groups which consists of the group of low and high belief in self-potential on personal health. If high stress is occurred on both sample groups, the peoples who have low belief in self-powered tend to feel insecurity and not belief in their potential to apply the recommendation activities. Therefore, the confidence in self potential is one of the most important parameter which made people believe in their potential and apply the recommendation activities more easily. However, the people with high belief in self potential will tend to do thing with confidence but if the confidence level of self-potential decrease, it become to be the barricade to the recommendation practices. Therefore, to motivate peoples to apply the recommendation activities do not rely only on the clear and visibility of the communication or media but also depend on the self-belief in personal potential on each person and their belief in changing of their behavior. So, the belief in self-efficacy and potential to apply and track to the recommendation behaviors are strongly related to each other.

From the above described on each parameter, we found that the belief in self-efficacy and the expectation on the response to personal effectiveness have

strongly related on to each other. When people recognize to the benefits of the activities or behavior changing and feel like it is practical to apply, the relation shown that the level of self-efficacy and effectiveness of the results become increase which made people give more concentrate on their behavior changing. In the other hand, if the self-efficacy is high but the results does not go well the level of concentration to the behavior changing become to decrease.

From the evolution of the protection motivation theory, Rogers tried to improve the theory via the study on 4 parameters as follows: perceived severity, perceived probability, perceived response efficacy and perceived self-efficacy which can be concluded to two types of the perception process as follows:

1) Threat Appraisal including perceived severity and perceived probability.

2) Coping Appraisal including perceived response efficacy and perceived self-efficacy.

The perception process is influenced by the information sources such as environment communication, observation, personality and personal experience as shown in Figure 2.3

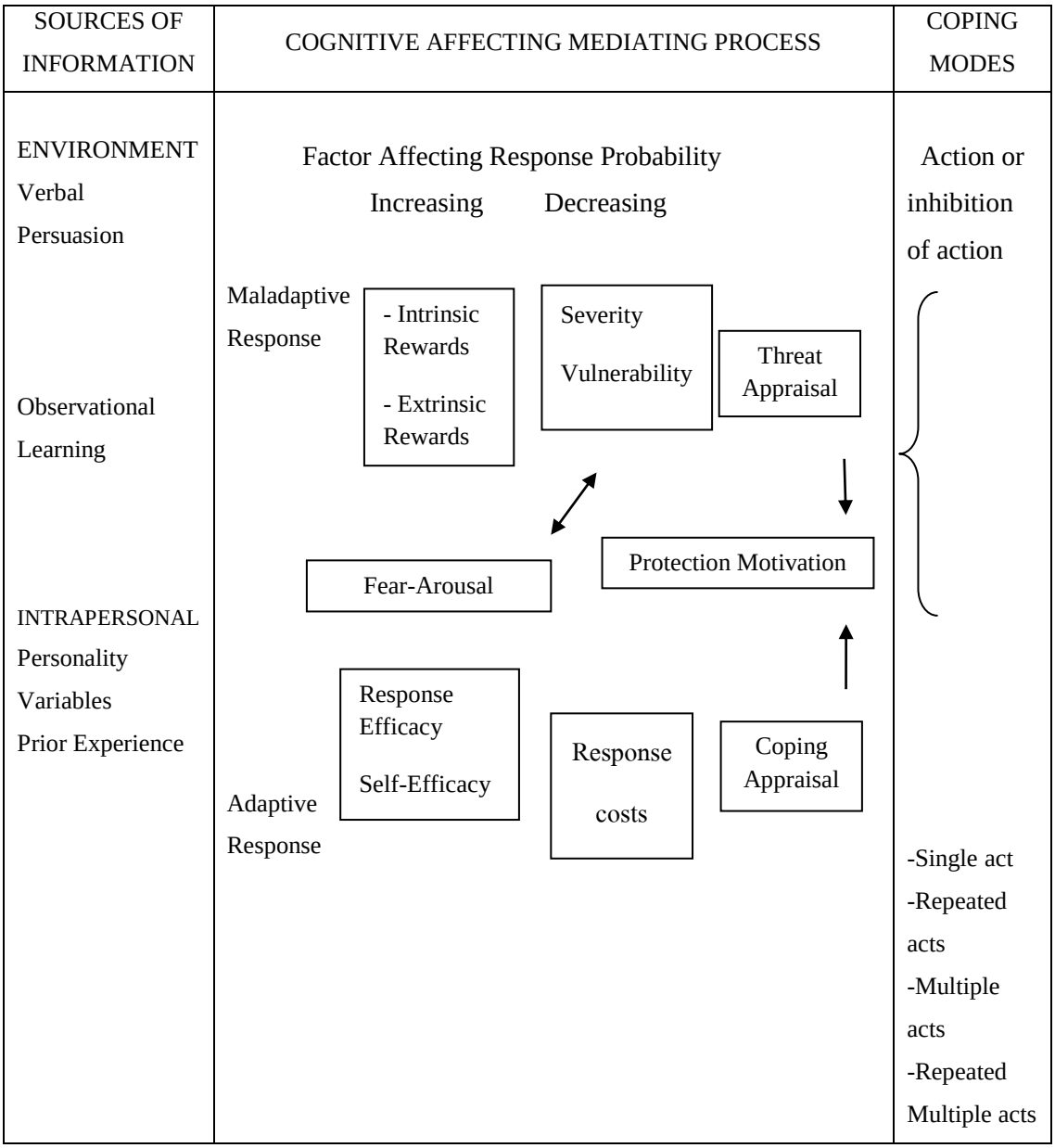


Figure 2.3 Protection Motivation Theory (Rogers, 1983)

The health risk assessment is consists of perceived severity and perceived susceptibility. These perceptions will belong to the change of mindset and behavior; moreover it can affect the response to desirable health behavior and motivation such as always tighten seat belt, quit smoking or undesirable behavior such as avoid tighten seat belt, start smoking.

Coping appraisal is consists of perceived response efficacy and perceived self-efficacy which is the important factor for the desired behavior changing and reduce the possible risk. However, other factors can impact the effectiveness of this

response such as inconvenient, cost, difficulty, confusion, complications and inappropriate to daily routine.

In summary, in protection motivation theory, the best motivations for health protection occur when the situation is as follow:

- People know the health impact is severe
- People aware of their weakness and their risk on health issues
- People belief that the response by changing health behavior is the best ways to avoid health impact
- People feel confidence that they can adapt, response and change their behavior completely
- The benefits from their response to avoid undesired behavior is low
- The obstacle for behavior changing is low

From the study on protection motivation theory indicated that people need to believe in the impact and risk of the health issues, response effectiveness expectation and their ability to change their behavior. It will increase level of intention and people can change their behavior. Therefore, the concept of this theory was applied in learning activities to increase level of understanding and awareness of severity level of occupational risk, probability of occupational risk and increase level of expectation to response effectiveness and self-efficacy in safety behavior. The expectation on self-efficacy and implemented results is strongly related which effect the decision making for behavior changing of each people as shown in Figure 2.4

		Perceive of response efficacy	
		High	Low
Perceive of self-efficacy	High	Exactly do	Likely do not
	Low	Likely do not	Not Exactly do

Figure 2.4 A relation of perceive response efficacy and perceive self-efficacy (Bandura, 1978)

The factors related to perception of self-efficacy were presented by Bandura which consist of four factors (16) are as follows.

A. Mastery Experience: Bandura believe that this is the most efficient way for improve awareness of self-efficacy because it is the direct experience, the success can increase employee ability and they will believe in their own potential. Therefore, the development of self-efficacy need to perform by increase employee skills together with let them aware of their own abilities. People will use their trained skills in most efficient way when they know their own skills and will never easily give up but still continuously work to achieve the target.

B. Modeling: the observation on complex behavior model and its desired results can motivate the observed persons to recognize, they also can success if they undiscouraged try hard enough to achieve it. The modeling principle affects people's feeling and awareness of their own potentials such as the solution of the individuals who are afraid of something can be solved by using of the related model that similar to people of the case. It can reduce the fear in it.

C. Verbal Persuasion: Bandura said, to say that the person has the ability to succeed, a relatively easy and commonly used approach is the combination of verbal persuasion and encourage people to achieve successful experiences that need to gradually improvement as per step together with persuasive speech. However, it would be beneficial to the development of their self-efficacy.

D. Emotional Arousal: the emotional arousal effect the level of self-efficacy. The person who had negative stimulus such as being in a state of intimidation can cause anxiety and stress. Moreover, this may cause fear and will lead to lower their self-efficacy. If this kind of emotional increase, it makes the person unable to express themselves well. This will raise to the failure experiences and lowest their self-efficacy. However, if a person can reduce or stop the emotional stimulus, he can improve their self-efficacy.

2.5.3 Behavior Based Safety (19)

Behavior Based Safety is the psychology and behavioral science branch related to behavior changing for correction of unsafe behaviors or at-risk behaviors that lead to accident or personal injury of the employees. The behavior changing

process is importantly considered and focused base on the employees' behavior to analyze on why employee had their action or behavior like this and then find out the recommendation activities to improve the behavior for highly appropriate.

The process of behavior changing for safe operation consists of:

1) Management level staffs and all employees need to share the same goals and opportunity to join the activities thoroughly the organization.

2) The expectation and desired behavior that need to achieve must be specified base on the safety evaluation.

3) Data collection from the observation

4) Consideration of the collection data for choosing of the most appropriated process execution

5) Notify the process progress and feedback to employees and all participant to let them know the current status and result of the activities.

6) Evaluate the result from the activities.

Moreover, the behavior changes for safe action, the need on changing of attitude and mindset of employee according to the concept of "Behavior effect to Attitude and Attitude effect to Behavior" need to apply. To achieve the target of this process, each step need gradually and continuously implement because Behavior Based Safety is not the process that start and finish within short amount of time but this process required continuously determination from all level of employee thoroughly the organization.

Presently, behavior based safety is implemented in various forms. The types of implements are different in budget, process, detailed activities and level of determination in each organization. However, the target of most process is still the same which is to reduce and eliminate possible cause of risks and personal injury. The study on BBS research paper about behavior changing for safety since 1970s, indicate that the difference process lead to difference results. One of the most successful processes in behavior based safety is the group of employees' behavior changing which have a purpose for reduction in at- risk behaviors and personal injuries.

2.5.4 The History of Behavior Based Safety (20)

The study of Behavior Based Safety was started by Judi Komaki the psychologist from the Georgia Institute of Technology. Komaki applied the ABD model to improve the potential of industry and later on applied it for solving of safety behavior problems of bakery industry which also called as Behavior Based Model in 1978.

In 1977, Dr. Komaki and Dr. John Hidley his assistant psychiatrist were offered to be consultant for drilling equipment manufacturing company in California for the creation of innovation for improvement of safety behavior. Dr. Komaki applied the behavior analytical principle (ABC model) for the development of safety behavior improvement. At the same time, Dr. Komaki aware of the development on behavioral science by Gene Earnest and Jim Palmer who firstly introduced the phase "Behavior based safety".

At present, the phase "Behavior Based Safety" becomes the most common word using by safety specialist and consultant. Typically, this word is used to reflect the tactics in occupational health and safety management or avoidance of unsafe or at-risk behavior which agree to be frequent sources of less to severe damage. Therefore, these obviously indicate that to avoid possible health risks, the reduction of at-risk behavior need to be applied with main concept on changing of safety behavior initiate improvement in injury.

2.5.4 Concept of Behavior Based Safety (21)

H.L. Kaila (2006) has presented the concept of Behavior Based Safety (BBS) to apply the concept and process of BBS to minimize at-risk behavior, accident probability and promote the work safety behavior in the Indian Journal of Occupational and Environment Medicine in the title of "Behavior based safety in organizations" as the following:

Behavior Based Safety (BBS) is the teamwork with support from the organization management level staff and implement by staffs or employees. The BBS is the activities that implement by human for human benefits which is the foundation of psychology theory. The aims of the BBS is not to force of safety regulation,

punishment, complaint or report to management level but it is the moral support, admire and support for safety action that implemented by staffs or employee.

Behavior Based Safety indicate safe and unsafe behavior of employee during working process and enhance communication ways and open mindedness which lead to personal safety problem solving and improve of safety carefulness network of the employee. If BBS has been correctly implemented with associate of all concern parties throughout the organization, it can increase safe behavior and reduce unsafe behavior of employee at the same time, reduce injury risk, accident probability and its incurred cost.

2.5.5 Basic Principles of Behavior Based Safety (22)

E. SCOTT GELLER (2005) presented the principles for safety behavior changing for applying based on seven basic principles which can improve the variety of support activities and reduce the cost of implementation as follows:

1) Focus Intervention on Observable Behavior: the specific goal need to be set before the execution of change. The BBS focused on "What our employee do? Why they do like that?. The information obtain from the analysis will be brought to apply and find out for the technical for behavior changing.

2) Look for External Factors to understand and Improve Behavior: such as working skills, work characteristic and the suitability of the employee. The obtained results will be used for the improvement of safety behavior.

3) Direct with Activators and Motivate with Consequence: the reason of why this activities is occurred need to be understood to describe the motivation force and expectation of employee for their actions to achieve desired results and avoid undesired results. Therefore, the motivation principles can be used to apply for behavior changing activities.

4) Focus on Positive Consequence to Motivate Behavior: the positive results from the implementation motivate the employee to perform the desired behavior. BBS evaluate the success of the execution by the reduction of injury and possible risk from working.

5) Apply the Scientific Method to Improve Intervention: the evaluation result of the before and after BBS implementation can assist the

improvement of the entire program, The “DO IT” principles can be used to teach employee for BBS principles, improve skill and enhance activities, the detailed of this step consist of 4 main part as follow:

5.1) Define behavior to target: in this step, it starts from specify the target behavior which can be at-risk behavior that we need to reduce or safe behavior that we need it to occur more frequent.

5.2 Observe to collect baseline data: in the learning process for baseline behavior data collection and consider of behavior changing parameter to reduce possible occupational risk by work observation and data recording to the behavior observation record form.

5.3) Intervene to influence target behavior: conduct the designed activities to increase safe behavior and reduce frequency of risk behavior such as safety slogan events, report the near miss incident and safe behavior agreement

5.4) Test to measure impact of intervention: all concern persons need to attend the discussion and analysis of execution results during evaluation process to verify the results is attain to the goal or not, what they have learned to improve and enhance efficiency of their activities using DO IT process in the evaluation are as follows:

- Consideration of personal specific problem.
- Track the effect of behavior changing activities
- Modify and adjust behavior changing activities.

6) Use Theory to Integrate Information, but not to limit Possibilities: in execution of BBS activities, the analysis results from the later execution activities need to apply for improvement of the process in addition to rely only on theoretical principles because one process cannot fit to all situations or all people. Therefore, the relation between activities results on specific situations or relation characteristics between people can lead to the development of higher efficiency standard process or activities.

7) Design Intervention with Consideration of Internal Feeling and Attitudes: the execution of behavior changing activities: the feeling and attitude of people on the activities need to be always considered because feeling and attitude of people had strongly influence to results of the activities. Therefore, BBS apply the

principle of positive reinforcement to support the implement of behavior changing activities more than the using of punishment to improve capability, trust and teamwork for the activities.

2.5.6 Behavioral Safety Process (23)

The following chart provides an overview of the stages in the implementation process.

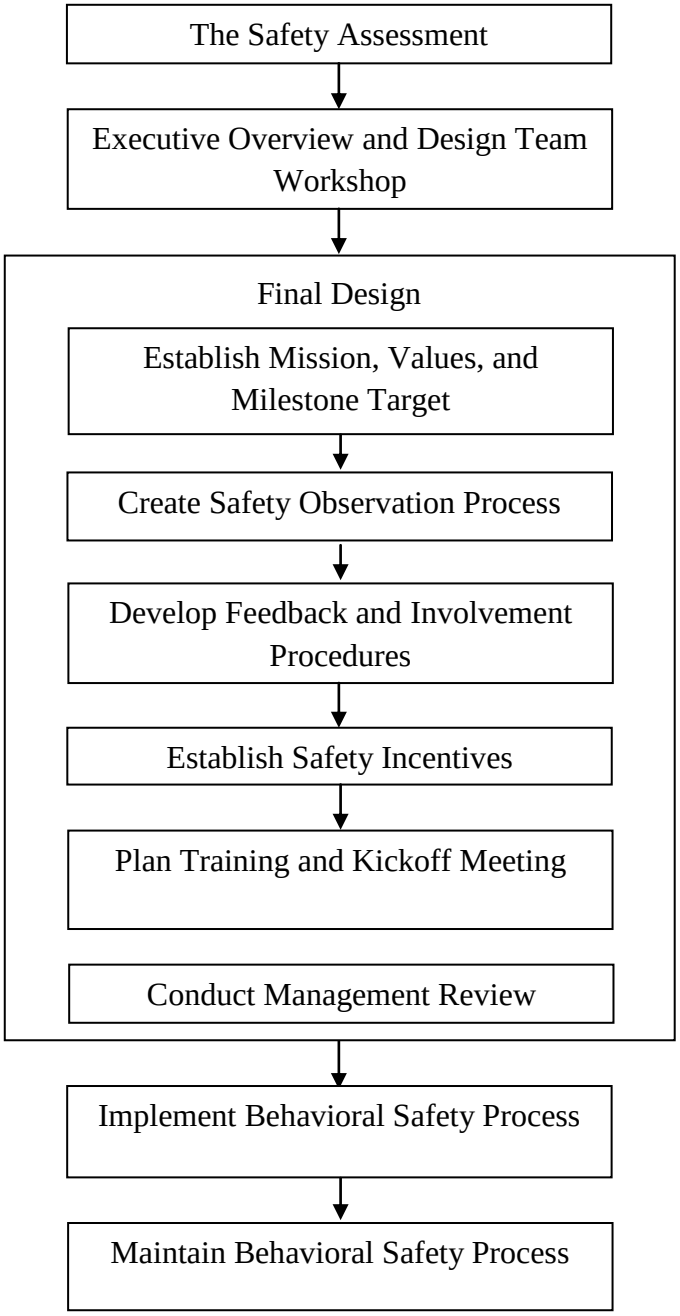


Figure 2.5 Behavioral Safety Process (Terry, 2003)

1) The Safety Assessment: is a formal study of your organization's current level of safety performance and the practices that impact safety. It is not the same as a safety audit. A safety assessment examines the process the organization uses to manage safety. A typical safety audit, on the other hand, examines the extent to which employees are in or out of compliance with established safety procedures and environmental condition are in or out of compliance with established requirement.

The purpose of the safety assessment

- An accurate and complete understanding of the organization's current safety efforts will result in better recommendations.

- The interviews, presentations, and discussions resulting from the assessment will help you build support for initiating improvement efforts.

2) Executive Overview and Design Team Workshop: a management overview is an orientation for management and supervisory personnel that introduces the enhancements you plan to make to the organization's safety improvement efforts. You should generally invite management personal who were not present at your assessment presentation, especially those from the work areas targeted for initial implementation. This meeting may have the same basic agenda as the final presentation of the assessment results except that you are now explaining plan that have management approval.

The purpose of the management overview

- To provide an overview of the elements of the behavioral safety process and why it is being implemented

- To ensure that line management knows how to support the implementation process at this stage

- To let people know how to influence the process

The initial workshop will generally include all of the people who will be participating in the design meetings. You may want to include a variety of other personnel. For instance, you might include volunteers from each shift and area involved in the implementation. You may choose to include union leadership or people from work areas that may develop a similar effort in the future. In particular,

you should consider including informal leaders who will help support your effort later if they understand what you are trying to do.

The purpose of the design team workshop

- To provide the necessary skills to those who will participate in the design process

- To build better understanding and support from key managers and employees

- To get initial input from participants as a basis for later development

3) Final Design: here you will be working with the design team to carry out the next phase of your recommendation; the development of a detailed implementation plan for the new safety process within your organization. The recommendations from your assessment along with initial ideas captured during the design team workshop will serve as a preliminary design and provide a starting point for the design team's efforts. This way you will not walk into a design team meeting and begin to brainstorm what the team members think needs to be done. Rather, you start by presenting the assessment recommendations and the rationale for those recommendations along with the team's input from the design team workshop. After this presentation, you change hats and become a participant in the meeting. As a participant, you work with the other team members to finalize the implementation plans.

Design team members may occasionally decide to proceed in a different way than you recommended on the basis of the assessment. As a team member, you have input into the team's decision, but you cannot force your views. IF the team wants to do something that differs significantly from the plan originally approved by management, you will need to go back to the management team and reach agreement on the team's purpose. Otherwise, trust the team process. If you do not agree with a course of action, say so and try to find a mutually agreeable course of action. You will often be able to support a team member's ideas while you continue to champion progress on the assessment recommendations.

Over the long team, the safety process should be responsive to data and experience. The group should ensure an observation process that gets

modified on the basis of incidents and near misses. The important thing is to create an adaptive system that responds to experience in ways that will help employees prevent future incidents and injuries.

In this phase, your goal is to work with the design team to complete detailed plans for enhancing your organization's process for managing safety in the work areas. Completion of the implementation plans usually means developing additional details for carrying out the assessment recommendations. The specific objectives include creating or enhancing the following:

- A safety observation process that provides a regular measure of on-the-job safety
- Feedback procedures for communicating and reviewing observation data
- Safety awards tied to on-the-job safety improvement
- An involvement processes that ensures ongoing involvement of all employees

4) Establish Mission, Values, and Milestone Target: identify activities that can be readily categorized into the following value categories:

- Concern for the well-being of others
- Open and honest communication
- Personal leadership
- Teamwork and employee involvement
- Continuous improvement

5) Create Safety Observation Process: an effective observation process offers the following advantages:

- Improves the safety practices of observers
- Results in better hazards recognition
- Provides feedback on the effectiveness of the safety process
- Establishes a baseline for setting improvement targets
- Provides practice in observing and discussing safety
- Adds social consequences for safe work practices and provides a basis for addition forms of employee recognition

The observation process also provides a measure of the success of your safety management process. By collecting data on safe practices, you have an in-process measure of safety. This use of observation data is in contrast with the traditional use of incidence rate data, which is an outcome measure of safety. An observation process provides an opportunity to work proactively with employees on their work practices before someone get hurt. It also enables you to evaluate the effectiveness of specific safety improvement efforts.

6) Develop Feedback and Involvement Procedures: creating an effective feedback and involvement process includes the following implementation tasks:

- Develop guidelines for using graphs.
- Plan reviews of safety process data: In safety meetings (observation data) and management meetings (data on the percent of observations completed)
- Develop guidelines for setting improvement goals.
- Establish guidelines to expand involvement in observations.

7) Establish Safety Incentives: there are three basic options in designing effective safety incentives:

- Create a safety award process
- Support the safety process through an existing compensation process
- Provide incentive compensation based on the safety process

The safety award process provides a way of celebrating successes and expressing appreciation to employees who work safely as well as those who make special contributions.

8) Plan Training and Kickoff Meeting: once you have planned recognition and celebration to support your safety process, you are ready to plan how you will introduce the process to employees, train observers, and other training that may be important to the success of your process. One of the decisions that you will have to make is weather you will need to have a kickoff meeting (or meeting) to introduce your process. Generally, you will need one unless you have a fairly small site and can get all employees through observer training in a fairly short time.

9) Conduct Management Review: once you have completed your planning efforts, the design team should present the behavioral safety process to management for its input and review. This step should be a critical milestone on your initial schedule. This meeting is an opportunity for management to provide input t the safety process, approve implementation of the new process, commit to its personal involvement, approve the budget for recognition and celebrations and provide recognition of the efforts of the design team.

10) Implement Behavioral Safety Process: the implementation of a behavioral safety process usually will be the responsibility of your steering committee. The steering committee has the primary responsibility for implementation the design team's plan as follows:

- Begin safety observations
- Ensure employees are trained to conduct observations
- Use observation data to drive improvement
- Develop plans for individual recognition and group celebration
- Administer and deliver safety awards.

11) Maintain Behavioral Safety Process: keeping the process alive requires sustained attention to the observations process (including reminding people to conduct their observations and, in particular, providing appreciative feedback to employees who have completed their observations.), use of the data, and recognition.

2.6 Literature cited

In 1998, Bungorn studied efficiency of program that provided knowledge by applied Protection Motivation Theory. Methods in Health Education are guidelines for the event to change riding behavior's student in Vocational School which consist of lecture, demonstration and practice. The results showed that after the experiment, the experimental group changed threat appraisal and coping appraisal and riding behavior of this group better than before and control group. (18)

In 1998, Kowit studied efficiency of program that provided knowledge by applied Protection Motivation Theory to promote occupational accident prevention behavior in a metal manufacturing factory. The results presented that the experimental group changed threat appraisal and coping appraisal and occupational accident prevention behavior better than before and control group. This studied indicated that health promotion program by applied the concept of Protection Motivation Theory able to increase worker's safety behaviors. (17)

In 1999, Sawacha studied factors affecting safety performance on construction sites. The effect of historical, economical, psychological, technical, procedural, organizational and the environmental factors considered in case of how these factors are connected to the level of site safety. The results showed the factors in top five that related to safety performance on construction sites in England were management focus on safety, providing safety manual, personal protective equipment, safety environment and safety at work training. (24)

In 2001, Valiporn studied the levels of safe behavior and factors associated with safe behaviors of workers in electric instrument factory by consider the motivation on an accident prevention of threat appraisal variable as perceived severity and perceived probability of the accident; the motivation on an accident prevention of coping appraisal variable as perceived self-efficacy and perceived response efficacy. The results showed that the motivation on an accident prevention of threat appraisal was not associated with safe behavior while the motivation on an accident prevention of coping appraisal was positive associated with safe behaviors and perceived self-efficacy can explain the variation of safe behaviors. (25)

In 2006, Thitipun studied the development of safe forklift driving in the Thai Polyethylene factory by applied Behavior Based Safety. The results showed that performances of the workers were safe behaviors all target and the accident rate was decreased. The studied can be concluded that Behavior Based Safety can reduced accident rate approximately 87.9 percent. (20)

In 2008, Pattamaporn studied the development safety behavior of service maintenance technician by using Behavior Based Safety in plaster factory. The results showed that the samples had the level of safe attitude either before or after studied was high approximately 100 percent while the level of safety behavior before studied was

high around 81.18 percent. As for the Behavior Based Safety implemented, so the behavior of every worker was in the high level with 100 percent. The safe behavior observation results by supervisor found that the workers can behave safely of all target approximately 100 percent since third month started. (10)

In 2012, Mingzong Zhang ,et al studied the continuous Behavior Based Safety strategy for persistent safety improvement in construction industry by applied Supervisory-Based Intervention Cycle (SBIC and a Behavior-Based Safety Tracking and Analysis System (BBSTAS). The studied found that after applied Supervisory-Based Intervention Cycle (SBIC) and a Behavior-Based Safety Tracking and Analysis System (BBSTAS) with positive approach and supervisor which he trained and advised how to work safety. In terms of the Behavior-Based Safety Tracking and Analysis System (BBSTAS), illustrating that the continuous Behavior Based Safety strategy is continuity index. The overall strategy is the methods that have a potential to achieve improvement safe behavior in construction site. (26)

In 2012, Dawei Chen and Hanzhi Tian studied Behavior Based Safety for accidents prevention and positive study in China construction project. The studied found that Behavior Based Safety can prevent the accident and increase safety index of the workers around 10 percent of baseline. Encouragement or appreciation to the workers who have safe behavior is the method to preserve of safe behavior better than punishment to the workers who have at-risk behavior because it received behavior improvement in the short-term. (27)

CHAPTER III
MATERIALS AND METHODS

3.1 Research Design

This study is the sequential-quasi-experiment study focusing on the results of behavioral change process between the Behavior Based Safety (BBS) and the Protection Motivation Theory (PMT) techniques. The purpose was to promote safe behaviors and reduce at-risk behaviors of the workers which are the main cause of the occupational accidents and injuries. This study divided subjects into two groups: the BBS and the PMT target groups. The data were collected to compare the results of change in behaviors before and after program implementation within and between groups.

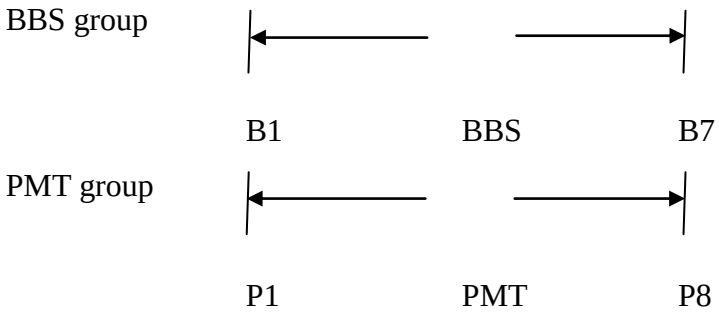


Figure 3.1 Research Design

By define B1 and P1 were data collected before program implementation
B7 and P8 were data collected after program implementation
BBS was BBS technique
PMT was PMT technique

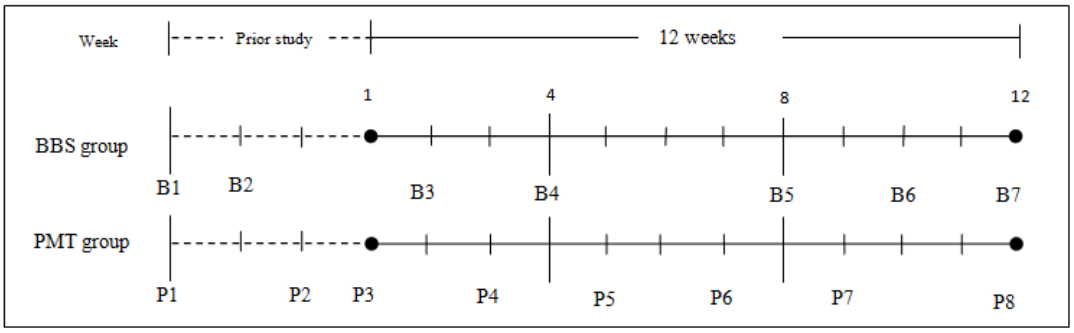


Figure 3.2 Research Plan

Table 3.1 The BBS and the PMT programs duration

Week	**Activity**	**Duration of operation (mins)**	**BBS**	**PMT**
Prior study	Pre-test data collected using self-administered questionnaires	60	B1	P1
Prior study	Identify the target safety behaviors and the behaviors observation training	60	B2	P2
1	Lectures and watch a video about safety at workplace.	60		P3
2	Workplace safety training	60	B3	
3	Model presentation by the worker who had experience the occupational accident and group discussions on the topic of an accident prevention and safety performance.	60		P4
4	Skills training and demonstration to wearing personal protective equipment.	60	B4	
5	Skills training and demonstration of “How to wear a personal protective equipment correctly” and encourage participants to work safely.	60		P5

Table 3.1 The BBS and the PMT program duration (cont.)

Week	Activity	Duration of operation (mins)	BBS	PMT
7/8	Group discussion about the results of program implementation, benefits consequences and problem solutions. Activities pledged themselves to work safely.	60	B5	P6
9/10	Activity quiz, enjoy the games about safety at workplace and promote the prevention of workplace accidents.	60	B6	P7
12	Post-test data collected using self-administered questionnaires.	45	B7	P8

3.2 Subjects and Sample size

3.2.1 Subjects

The subjects in this study were the polishing worker of 24 persons.

3.2.2 Sample size calculation

The sample size was calculated by equation below (28).

$$n = \frac{2\sigma^2(Z_{\alpha/2}+Z_{\beta}).^2}{\Delta^2}$$

Where

$Z_{\alpha/2}$ = Z score at 95% confidence interval (Z = 1.96)

β = determined β at 0.20 = 0.84.

$\Delta = \bar{x}_1 - \bar{x}_2$, The result of behavior scores by Nongrat, (1997) was 12.70. (29)

σ^2 is variances (6.73^2) by Nongrat, (1997) was 6.73^2. (29)

Thus

$$n = \frac{2*45.2929(1.96+0.84).^2}{161.29}$$

$$= 4.403 \approx 5 \text{ persons.}$$

The result from the calculation showed that the number of sample size was at least than five persons in each group and to prevent the withdrawal of the sample under study. Therefore, the sample size was increased to twice per group. There is a total of sample size of 20 persons.

3.2.3 The criteria selection of the participants.

Inclusion criteria

1) Be literate.

2) Be a worker, both of male and female.

3) Age between 18-59 years old.

4) Work experience for at least one year.

5) Voluntarily participation.

Exclusion criteria

1) Resigned or change in work characteristic during the study.

3.2.4 Selection sampling

1) The subjects were selected by purposive sampling method by considering the sampling subjects according to the inclusion criteria.

2) The subjects, 20 persons were selected by simple random sampling.

3.3 Tools

3.3.1 Behavior modification techniques

1) Behavior Based Safety procedures are as follows:

- Identify the at-risk behaviors and collect into the at-risk inventory. The target safety behaviors were selected by brainstorming and priority setting.

- Observe target safety behaviors and intervene to applauding when safe behaviors were implemented and reasonably warning when unsafe behaviors were discovered, then recommend the safe ones.

- Promote safe behaviors activities to encourage worker's motivation to the target safety behaviors.

- Evaluate the target safety behaviors.

2) Protection Motivation Theory procedures are as follows:

- Identify the at-risk behaviors and collect into the at-risk inventory. The target safety behaviors were selected by brainstorming and priorities setting.

- Promote and improve behavioral change by providing the safety knowledge training through the media, prompting fears of an accident, models presentation and convincing participants to realize the risk of accidents and self-efficacy to change their behavior.

- Observe target safety behaviors.

- Evaluate the target safety behaviors.

The details of both behavior medication techniques were shown in Figure 3.3.

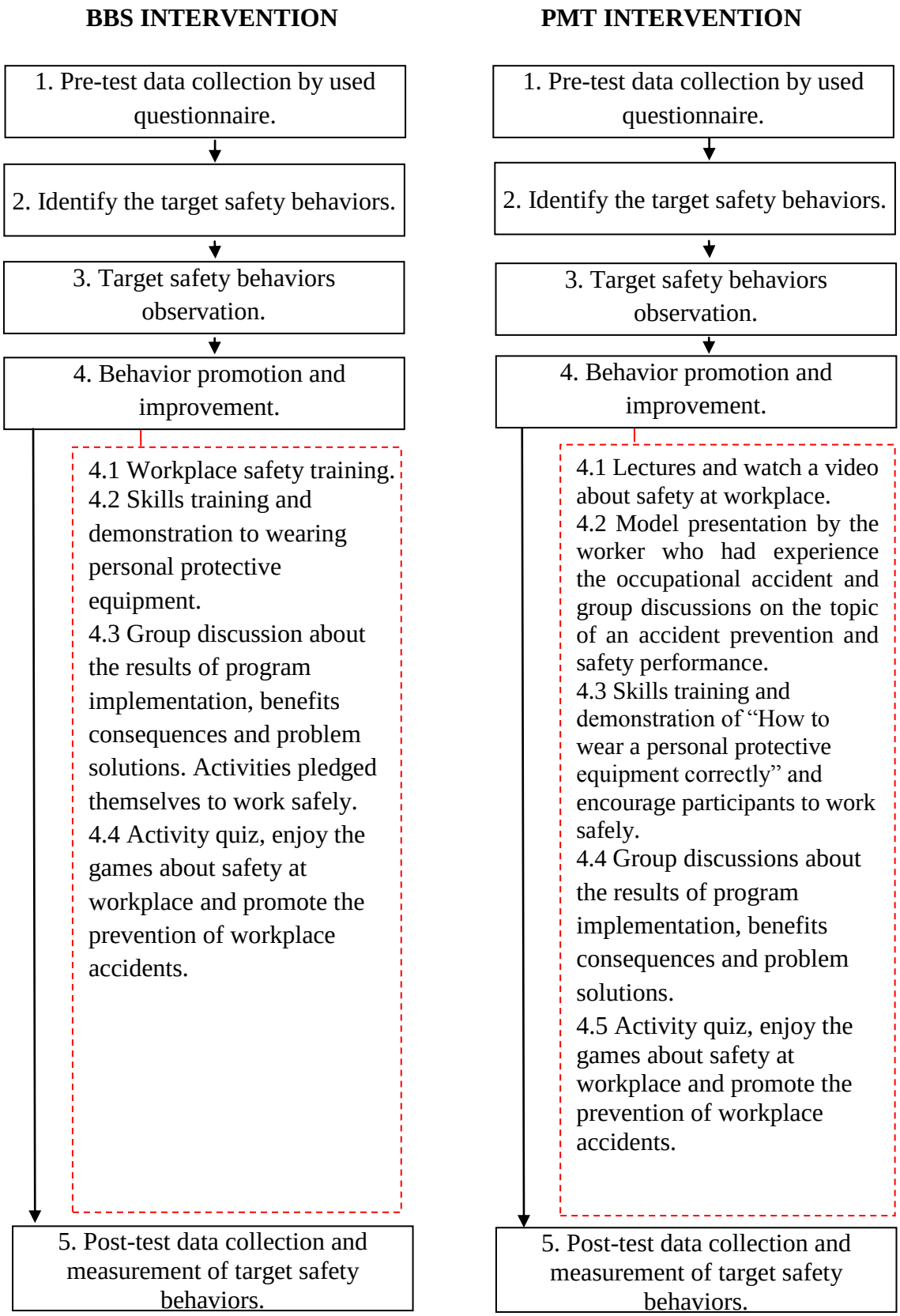


Figure 3.3 BBS and PMT intervention.

3.3.2 Tools used in training program of Behavior Based Safety and Protection Motivation Theory technique are as follows.

1) Lecture documents

2) Posters and public announcements about accidents severity, loss caused by the accident and accident prevention methods.

3) Media videos about workplace accidents, how to work safely and how to wear personal protective equipment correctly.

3.3.3 Tools for data collection

Self-Administered Questionnaire, which researcher improved from the previous research was divided into two sections. The first section was divided into four parts as follows:

The first part: General information questionnaire included gender, age, education level, work experience, training experience and accident experience.

The second part: Safety knowledge questionnaire, which had three scales from yes, not sure and no. The subjects can choose the only one choice according to his/her knowledge toward the questionnaire. The points are as follows:

Yes	2	points
Not sure	1	point
No	0	point

The third part: Safety attitudes questionnaire, it is scaled according to Likert Scale had five scales from agree strongly, agree, neither agree nor disagree, disagree and disagree strongly. The subjects can choose the only one choice according to his/her attitude toward the questionnaire. The points are as follows:

Opinion level	**Positive score**	**Negative score**
Agree strongly	5	1
Agree	4	2
Neither agree nor disagree	3	3
Disagree	2	4
Disagree strongly	1	5

The fourth part: Safety behaviors questionnaire, it is scaled according to Likert Scale had five scales from behavior practice including regularly, often,

sometime, seldom and never. The subjects can choose only one choice according to his/her behaviors toward the questionnaire. The points are as follows:

Behavior practice	Positive score	Negative score
Regularly	5	1
Often	4	2
Sometime	3	3
Seldom	2	4
Never	1	5

The second section is the satisfaction evaluation of the participants after they attended the behavioral change process through the BBS and the PMT techniques. This questionnaire had scaled according to Likert Scale had five scales from highly satisfied, satisfied, partially satisfied, not satisfied and not at all satisfied. The subjects can choose only one choice according to his/her satisfaction toward the questionnaire. The points are as follows.

Highly satisfied	5	points
Satisfied	4	points
Partially satisfied	3	points
Not satisfied	2	points
Not at all satisfied	1	point

3.3.4 Data interpretation criteria

The criteria for the data interpretation of knowledge, attitude and behaviors regarding safety at work questionnaires were calculated by the following formula:

$$\text{Interval} = \frac{\text{Higest score} - \text{Lowest score}}{\text{number of interval}}$$

The results can be classified into three levels as the following questionnaire aspects:

1) Safety knowledge questionnaire criteria are interpreted according to the following levels:

Score		**Interpretation**
0 – 10	points	Safety knowledge at low level
11 – 20	points	Safety knowledge at middle level
21 – 30	points	Safety knowledge at high level

2) Safety attitudes questionnaire criteria are interpreted according to the following levels:

Score		**Interpretation**
15 – 35	points	Safety attitude at low level
36 – 50	points	Safety attitude at middle level
51 – 75	points	Safety attitude at high level

3) Safety behaviors questionnaire criteria are interpreted according to the following levels:

Score		**Interpretation**
20 – 47	points	Safety behaviors at low level
48 – 74	points	Safety behaviors at middle level
75 – 100	points	Safety behaviors at high level

The mean satisfaction result of the behavior modification technique was calculated by the following formula:

$$\frac{\text{Higest score} - \text{Lowest score}}{\text{number of interval}}$$

The results can be classified into five levels as the following:

Mean of score		**interpretation**
1 - 1.8	points	Highly satisfied
1.81 - 2.60	points	Satisfied
2.61 - 3.40	points	Partially satisfied
3.41 - 4.20	points	Not satisfied
4.21 - 5	points	Not at all satisfied

3.4 Data collection

3.4.1 Research preparation

1) A letter of research inquiry from the Public Health Faculty of the Mahidol University was sent to company to inform the purpose and duration of research project.

2) Coordinate administrators on the purpose of the research project and the operation procedures.

3) Select samples according to the inclusion criteria and inform them about the purpose and the operation procedures in order to persuade workers who are eligible to participate and sign a form of consent after to joining the project.

4) Study about work process, work characteristic of the samples and the number of accidents in the workplace to serve as a guideline for planning the behavior change process.

5) Providing educational media to be used for the research project.

6) Coordinate with the related officer regarding location and audio visual equipment required in the project.

3.4.2 Research implementation

The duration of the research implement was twelve weeks. The details of the program implementation are as follows:

Week 1: The researcher informed the purpose of the research project and the operation procedure. Pre-test data collected using self-administered questionnaires including general information, knowledge, attitudes and behaviors regarding safety at work of subjects both in the BBS and the PMT groups.

Week 2: The subjects in the BBS and the PMT target groups were to identify the target safety behaviors by reviewing the previous an accident happened and brainstorming. The target safety behaviors observe training in order to make the subjects understand research process. The following guidelines are as follows:

- The subjects observed and recorded the target safety behaviors of each subject in their group by themselves at least once per week for twelve weeks.

- Summarized the results of safety behaviors observed on a weekly and monthly basis. The percentage of safe behavior was calculated from the observation.

Calculation for % safe behavior:

$$\% \text{ Safe behavior} = \frac{\text{Total safe observations}}{\text{Total safe observations+At-risk observations}} \times 100$$

Table 3.2 Behaviors Observation form of the BBS group

Target Safety Behaviors Observation form (BBS) **Observer code**……**Date**…../……/……		
Target safety behavior	**Safe behavior**	**At-risk behavior**
1.		
2.		
3.		
….		
n.		
รวม		
% Safe behavior = $\frac{\text{Total Safe observations}}{\text{Total safe observations+At-risk observations}}$ **x 100 =**……**%**		

Table 3.3 Behaviors Observation form of the PMT group

Target Safety Behaviors Observation form (PMT) **Observer code** ……**Date**…../……/……		
Target safety behavior	**Safe behavior**	**At-risk behavior**
1.		
2.		
3.		
….		
n.		
รวม		
% Safe behavior = $\frac{\textbf{Total Safe observations}}{\textbf{Total safe observations+At−risk observations}}$ **x 100 =**……**%**		

Week 3-12: Continue to promote and improve the behaviors of the subjects in each group. The details are as follows:

BBS group

Observation on the target safety behaviors of the subjects. The subjects observed and recorded safety behaviors of each worker in their group while they are working during the work hours, at least once per week. Behavioral change process evaluations of the subjects were calculated by percent safe behavior. Then, encouragement when found safe behaviors of co-workers, rationally warned and recommended safe practices when found unsafe behaviors. The plan of safety behaviors promotions are as follows:

Week 2: Workplace safety training (60 minutes)

Week 4: Skills training and demonstration to wearing personal protective equipment. (60 minutes)

Week 8: Group discussions about the results of program implementation, benefits consequences and problem solutions. Activities pledged themselves to work safely. (60 minutes)

Week 10: Activity quiz, enjoy the games about safety at workplace and promote the prevention of workplace accidents. (60 minutes)

PMT group

Observation on the target safety behaviors of the subjects. The subjects observed and recorded safety behaviors of each worker in their group while they are working during the work hours, at least once per week. Behavioral change process evaluations of the subjects were calculated by percent safe behavior. The plan of safety behaviors promotions are as follows:

Week 1: Lectures and watch a video about safety at workplace. (60 minutes)

Week 3: Model presentation by the worker who had experience the occupational accident and group discussions on the topic of an accident prevention and safety performance. (60 minutes)

Week 5: Skills training and demonstration of "How to wear a personal protective equipment correctly" and encourage participants to work safely. (60 minutes)

Week 7: Group discussions about the results of program implementation, benefits consequences and problem solutions. Activities pledged themselves to work safely. (60 minutes)

Week 9: Activity quiz, enjoy the games about safety at workplace and promote the prevention of workplace accidents. (60 minutes)

Week 12: Pre-test data collected using self-administered questionnaires including general information, knowledge, attitudes and behaviors regarding safety at work of subjects both in the BBS and the PMT target groups. The target safety behaviors were measured from the percentage of safe behavior calculation and evaluated the subjects' satisfaction to the behavioral change process through the BBS and the PMT techniques.

3.5 Data and statistical analysis

3.5.1 Data analysis

The data were analyzed by SPSS (Statistical Package for the Social Science) version 17.0 for window.

3.5.2 Statistical analysis

The statistical analysis can be divided into two parts as following:

3.5.2.1 Descriptive statistics

1) General values were obtained using descriptive statistics. This includes frequency, percentage, arithmetic mean, and standard deviation.

3.5.2.1 Inferential statistics

1) The comparison of knowledge, attitudes and behaviors regarding safety at work and target safety behaviors before and after program implementation within the BBS and the PMT target groups were compared by Paired Sample t-test at the 95% confident interval.

2) The comparison of knowledge, attitudes and behaviors regarding safety at work and target safety behaviors before and after program implementation between the BBS and the PMT target groups were compared by Mann-Whitney U test at the 95% confident interval.

3.6 Ethical Consideration

The research protocol was reviewed and approved by Ethical Review Committee for Human Research Faculty of Public Health, Mahidol University, protocol number MUPH 2014-124 (see Appendix A).

CHAPTER IV
RESULTS

The study of the results of the changes in target safety behaviors by applied the Behavior Based Safety (BBS) and the Protection Motivation Theory (PMT) techniques among polishing workers in a factory. The researcher had collected data, before and after the behavioral change program implementation from the questionnaires and the behaviors observation form. This will be presented as follows:

4.1 General information and characteristics of the subjects.

4.2 The results based on the first hypothesis.

4.3 The results based on the second hypothesis.

4.4 The results based on the third hypothesis.

4.5 The satisfaction evaluation result.

4.1 General information and characteristics of the subjects

The subjects in this study were from the polishing department with a total number of 20 persons. They were divided into two groups including 10 workers in the BBS target group and 10 workers in the PMT target group. They could be classified according to the subject characteristics as follows:

1) Gender: the BBS target group composed of 9 males (90%); 1 female (10%) and the PMT target group composed of 7 males (70%); 3 females (30%).

2) Age: The average age of the BBS and the PMT target groups were 33.60 and 34.10 years old.

3) Education level: The most education level was secondary degree. The proportion of the BBS and the PMT target groups were 90% and 60%.

4) Work experience: The average work experience of the BBS and the PMT target groups were 7.72 and 6.46 years.

5) People who had experience in occupational safety training: the BBS target group was the number of people who have been trained; 9 persons (90.0%). The number of people who have never been trained; 1 person (10.0%). The PMT target group was the number of people who have been trained; 7 persons (70.0%) and the number of people who have never been trained; 3 persons (30.0%).

6) People who had experience a workplace accident: The BBS and PMT target group have a number of people who had experienced a workplace accident; 2 persons (20.0%) and the number of people who had never experienced a workplace accident; 8 persons (80.0%) as were in Table 4.1.

Table 4.1 General information and the subjects' characteristics

Characteristic	BBS		PMT	
	frequency	**percent**	**frequency**	**percent**
1.Gender				
Male	9	90.0	7	70.0
Female	1	10.0	3	30.0
2.Age (years)				
< 20	1	10.0	1	10.0
20-30	0	0.0	2	20.0
31-40	8	80.0	6	60.0
>40	1	10.0	1	10.0
	Mean = 33.60 S.D. = 6.60		Mean = 34.10 S.D. = 9.87	
	Max = 44 Min = 20		Max = 57 Min = 19	
3.Education level (number)				
Primary school	1	10.0	4	40.0
Secondary school	9	90.0	6	60.0

Table 4.1 General information and the subjects' characteristics (cont.)

Characteristic	BBS		PMT	
	frequency	**percent**	**frequency**	**percent**
4.Work experience (years)				
< 5	1	10.0	5	50.0
5-10	8	80.0	2	20.0
10-15	0	0	3	30.0
>15	1	10.0	0	0.0
	Mean = 7.72 S.D. = 3.45		Mean = 6.46 S.D. = 4.27	
	Max = 15.42 Min = 2.25		Max = 11.92 Min = 1.33	
5.Training experience (number)				
Yes	9	90.0	7	70.0
No	1	10.0	3	30.0
6.Accident experience (number)				
Yes	2	20.0	2	20.0
No	8	80.0	8	80.0

4.2 The results based on the first hypothesis

First hypothesis is the target safety behaviors of the workers before and after the behavioral change through the Behavior Based Safety technique are different. The results can be divided into two parts as the following;

4.2.1 The comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation within the BBS target group

The mean of safety knowledge before program implementation was 24.70 with a standard deviation of 2.71. After program implementation was 27.30 with a standard deviation of 1.57. The results of the safety knowledge comparison between before and after program implementation was significantly different at the 95% confidence level (p-value = 0.040).

The mean of safety attitudes before program implementation was 62.50 with a standard deviation of 3.44. After program implementation was 65.80 with a standard deviation of 5.33. The results of the safety attitude comparison between before and after program implemented was significantly different at the 95% confidence level (p-value = 0.014).

The mean of safety behaviors before program implementation was 81.80 with a standard deviation of 9.71. After program implementation was 84.50 with a standard deviation of 9.51. The results of the safety behaviors comparison between before and after program implementation was not significantly different at the 95% confidence level (p-value = 0.245) as were in Table 4.2.

Table 4.2 Comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation within the BBS target group (n=10)

Questionnaire	BBS		df	t	p-value[a]
	$\bar{x}$	S.D.			
Knowledge					
Before	24.70	2.71	9	-2.391	0.040
After	27.30	1.57			
Attitudes					
Before	62.50	3.44	9	-3.039	0.014
After	65.80	5.33			
Behaviors					
Before	81.80	9.71	9	-1.244	0.245
After	84.50	9.50			

Note: a = Paired Samples T-Test

4.2.2 The comparison of the target safety behaviors before and after program implementation within the BBS target group

The mean of percentage of safe behavior before program implementation was 88.89 with a standard deviation of 14.59. After program implementation was 100.00 with a standard deviation of 0.00. The results of the percentage of safe behavior comparison between before and after program implementation was

significantly different at the 95% confidence level (p-value = 0.039) as were in Table 4.3.

Table 4.3 Comparison of the target safety behaviors before and after program implementation within the BBS target group (n=10)

BBS	$\bar{x}$ (% safe)	S.D.	df	t	p-value[a]
Before implementation	88.89	14.59	9	-2.410	0.039
After implementation	100.00	0.00			

Note: a = Paired Samples T-Test

4.3 The results based on the second hypothesis

Second hypothesis is the target safety behaviors of the workers before and after the behavioral change through the Protection Motivation Theory technique are different. The results can be divided into two parts as the following;

4.3.1 The comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation within the PMT target group

The mean of safety knowledge before program implementation was 25.00 with a standard deviation of 3.30. After program implementation was 25.90 with a standard deviation of 3.54. The results of the safety knowledge comparison between before and after program implementation was not significantly different at the 95% confidence level (p-value =0.438).

The mean of safety attitudes before program implementation was 62.20 with a standard deviation of 7.30. After program implementation was 64.70 with a standard deviation of 7.19. The results of the safety attitude comparison between before and after program implementation was not significantly different at the 95% confidence level (p-value = 0.244).

The mean of safety behaviors before program implementation was 89.00 with a standard deviation of 11.33. After program implementation was 90.20 with a

standard deviation of 10.06. The results of the safety behaviors comparison between before and after program implementation was not significantly different at the 95% confidence level (p-value = 0.639) as were in Table 4.4.

Table 4.4 Comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation within the PMT target group (n=10)

Questionnaire	PMT		df	t	p-value[a]
	$\bar{x}$	S.D.			
Knowledge					
Before	25.00	3.30	9	-0.811	0.438
After	25.90	3.54			
Attitudes					
Before	62.20	7.30	9	-1.246	0.244
After	64.70	7.19			
Behaviors					
Before	89.00	11.33	9	-0.485	0.639
After	90.20	10.06			

Note: a = Paired Samples T-Test

4.3.2 The comparison of the target safety behaviors before and after program implementation within the PMT target group

The mean of percentage of safe behavior before program implementation was 92.59 with a standard deviation of 8.19. After program implementation was 98.17 with a standard deviation of 3.09. The results of the percentage of safe behavior comparison between before and after program implementation were significantly different at the 95% confidence level (p-value = 0.021) as were in Table 4.5.

Table 4.5 Comparison of the target safety behaviors before and after program implementation within the PMT target group (n=10)

PMT	$\bar{x}$ (% safe)	S.D.	df	t	p-value[a]
Before implementation	92.59	8.19	9	-2.802	0.021
After implementation	98.17	3.09			

Note: a = Paired Samples T-Test

4.4 The results based on the third hypothesis

Third hypothesis is the Behavior Based Safety technique and the Protection Motivation Theory technique yield different effects in target safety behaviors change. The results can be divided into two parts as the following;

4.4.1 The comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation between the BBS and the PMT target groups

The median of safety knowledge before and after program implementation in the BBS target group was 2.00 with the interquartile range Q1-Q3 was 0.00-5.50. In the PMT target group was 1.50 with the interquartile range Q1-Q3 was 0.00-2.50. The results of the safety knowledge comparison before and after program implementation between the BBS and the PMT target groups were not significantly different at the 95% confidence level (p-value = 0.492).

The median of safety attitudes before and after program implementation in the BBS target group was 4.00 with the interquartile range Q1-Q3 was 1.00-4.50. In the PMT target group was 3.00 with the interquartile range Q1-Q3 was -1.25-7.50. The results of the safety attitude comparison before and after program implementation between the BBS and the PMT target groups were not significantly different at the 95% confidence level (p-value = 0.939).

The median of safety behaviors before and after program implementation in the BBS target group was 1.50 with the interquartile range Q1-Q3 was -2.00-9.50. In the PMT target group was 0.50 with the interquartile range Q1-Q3 was -3.25-3.00.

The results of the safety behaviors comparison before and after program implementation between the BBS and the PMT target groups were not significantly different at the 95% confidence level (p-value = 0.383) as were in Table 4.6.

Table 4.6 Comparison of knowledge, attitudes and behaviors regarding safety at work before and after program implementation between the BBS (n=10) and the PMT (n=10) target groups

Techniques		Median	Q1-Q3	p-value[b]
Knowledge				
	BBS	2.00	0.00-5.50	0.492
	PMT	1.50	0.00-2.50	
Attitudes				
	BBS	4.00	1.00-4.50	0.939
	PMT	3.00	-1.25-7.50	
Behaviors				
	BBS	1.50	-2.00-9.50	0.383
	PMT	0.50	-3.25-3.00	

Note: b = Mann-Whitney U test

4.4.2 The comparison of the target safety behaviors before and after program implementation between the BBS and the PMT target groups

The median of the target safety behavior before and after program implementation in the BBS target group was 5.56 with the interquartile range Q1-Q3 was 0.00-18.06. In the PMT target group was 3.06 the interquartile range Q1-Q3 was 0.00-11.11. The results of the target safety behaviors comparison before and after program implementation between the BBS and the PMT target groups were not significantly different at the 95% confidence level (p-value = 0.634) as were in Table 4.7.

Table 4.7 Comparison of the target safety behaviors before and after program implementation between the BBS and the PMT target groups

Techniques	Median	Q1-Q3	p-value[b]
Target safety behaviors			
BBS	5.56	0.00-18.06	0.634
PMT	3.06	0.00-11.11	

Note: b = Mann-Whitney U test

4.5 The satisfaction evaluation result

The result of the satisfaction evaluation of the behavioral change process through the BBS and the PMT techniques were divided into five levels. The result showed that the subjects in the BBS and the PMT target groups were highly satisfied to the behavioral change process of both techniques.

CHAPTER V
DISCUSSION

The discussion of the study of the changes in target safety behaviors through the Behavior Based Safety technique (BBS) and the Protection Motivation Theory technique (PMT) are as follows:

5.1 Discussion of study design

5.2 Discussion of study result

5.1 Discussion of study design

5.1.1 Human error

The human errors that could occur in the study include

5.1.1.1 Human error from the researcher: the researcher lacks experience, leading to the lack of ability to impart the knowledge and motivate the workers. Another possible error is when there are more than one behavior changers, i.e. the workers in the groups receiving behavioral change through the BBS and the PMT techniques are not trained by the same person. This could affect their perception and their behavioral change. Thus, the researcher must assume the role of the sole trainer and behavior changer for both groups.

5.1.1.2 Human error from the participants: the participants are unprepared and do not understand the methods of behavioral change. Therefore, the researcher has prepared the participants by informing them of the study details and training them about the methodology and process of behavioral change prior to the study.

5.1.2 Method error

The method errors that could occur in this study include

5.1.2.1 In the behavioral change using PMT technique, the design of the knowledge impartation could be incongruous with the behavioral change method based on the Protection Motivation Theory. Hence, the researcher has studied and planed the training to effect behavioral change and promote behaviors corresponding with PMT.

5.1.2.2 In the behavioral change using the BBS technique, the BBS technique could be applied incorrectly. Thus, the researcher has both done extensive research and received training in Behavior Based Safety technique in order to induce accurate understanding and application of the BBS technique in the study.

5.1.3 Instrument error

The instrument errors that could occur in the study include

5.1.3.1 The accuracy of the questionnaire used in data collection is low. The researcher has attempted to lower the risk of this error by having the questionnaire verified by an expert regarding the number of questions, the clarity of the questions, and the language used. The questionnaire was then tried out with a group of workers that share characteristics with the subjects to determine the accuracy. Then, after undergoing revisions until the accuracy is in an acceptable rate, the questionnaire was used in the real study.

5.1.3.2 The interpretation and completion of the behavior observation form are incorrect. This could be attributed to misunderstanding in the method of recording and the language used in the behaviors observation form. Therefore, the researcher has explained the method and given examples of behavior observations and recording in the form to induce accurate and corresponding recording.

5.2 Discussion of study result

The results of the study can be summarized as seen in Table 5.1. The discussion of the study results are as follows:

Table 5.1 The comparison of knowledge, attitudes, and behaviors regarding safety at work and target safety behaviors between before and after the study within and between groups

Behavior modification techniques	**Safety at work questionnaire**			**Behaviors Observation form**
	Knowledge	**Attitudes**	**Behavior**	**Target safety behaviors**
1. Compare within the BBS group	Significant	Significant	Non-significant	Significant
2. Compare within the PMT group	Non-significant	Non-significant	Non-significant	Significant
3. Compare between the BBS and the PMT groups	Non-significant	Non-significant	Non-significant	Non-significant

5.2.1 Discussion of study result based on the first hypothesis

The results of the study support the hypothesis that the target safety behaviors of the workers before and after the behavioral change through the Behavior Based Safety technique are different. The result shows that the knowledge, attitudes, and behaviors of the workers regarding safety at work increased from before. This corresponds with the study by Pathamakorn Todsapon (2008) which found that the behavioral change through BBS increased the levels of attitudes and behaviors regarding safety at work. As the workers receive training and participate in activities concerning occupational safety, resulting in more positive knowledge, attitudes, and behaviors toward safety at work than prior to the study.

Nevertheless, a comparison between the questionnaire answers on the knowledge, attitudes, and behaviors regarding safety at work before and after the BBS behavioral change yielded some differences. The cause of this could be the average age of the subjects in the BBS target group which is lower than that of the PMT target group and the higher number of high school graduates. Consequently, this group of workers are better equipped and have more interest to learn. In addition, the majority of the workers in the BBS target group have had experiences in occupational safety

training, causing them to memorize and understand the knowledge from the training more efficiently than those who have never received any training. These reasons led to a more positive attitude than before the behavioral change. In terms of safety behaviors, it was found that after the study, the target group's average score of behaviors regarding safety at work was higher than before the study although there were no significant differences between before and after the application of the BBS technique. This could be because the assessments from before and after resulted in only slight differences, amounting to no significance in terms of statistics.

Moreover, the behaviors observations found that the workers developed increased safety behaviors compared to before the study from 88.89% to 100% at the end of the study. The trend of target safety behaviors are likely to continue, which corresponds with the study conducted by Dawei Chen and HanzhiTian (2012) which found that the application of BBS in behavioral change could increase the safety indices of the workers. This indicates that positive communication, compliments and recommendations continuously made about safety behaviors at work to coworkers can persuade workers to change their behaviors with more realization and consideration to safety at work.

5.2.2 Discussion of study result based on the second hypothesis

The results of the study support the hypothesis that the target safety behaviors of the workers before and after the behavioral change through the Protection Motivation Theory technique are different. The results indicated that the workers developed more knowledge, attitudes, and behavior regarding safety at work than before the study, which is resulted from their perception of the severity and risk of occupational accident from the unsafe acts or at-risk behaviors.

Nonetheless, a comparison between the questionnaire answers on the knowledge, attitudes, and behaviors regarding safety at work before and after the BBS behavioral change yielded no differences. One cause could be that the assessments from before and after had only small differences, implying no statistical significance. Furthermore, the PMT target group has less average work experience and lower number of those who have been trained in safety at work than the BBS target group.

As a result, the PMT target group had lower potential to learn and understand the information given in the training.

Moreover, the behaviors observations found that the workers developed increased safety behaviors compared to before the study from 92.59% to 98.17% at the end of the study due to the acknowledgement of the benefits of behavioral change and of their capability to change the behaviors based on the recommendations. The results correspond with the study of Kowit Boonmeepong (1998) which found that after the application of the PMT technique and the training program, the workers have developed more correct perceptions of accidents at work, leading to increased prevention of accidents at work. Nevertheless, the study showed that the workers could not yet perform 100% of the target safety behaviors because the trainings were conducted too far apart. That is, the behavioral trainings through the PMT technique were organized only twice a month, causing inconsistent stimulation of perceptions and behaviors regarding safety. This potentially led to lower quality of persuasion and information reception for the workers, which affected their safety behaviors.

5.2.3 Discussion of study result based on the third hypothesis

The results of the study do not support the hypothesis that the Behavior based safety technique and the Protection Motivation Theory technique yield different effects in target safety behaviors change. The results demonstrate that the behavioral change through both techniques have the potential to change the employees' behavior regarding safety at work. The BBS and PMT techniques could increase the employees' safety behavior. However, the comparison of behavioral change revealed that the changes induced by both techniques do not significantly different. This could be a result of the two groups are small in number and are closely connected, leading to an exchange of information during the study. Receiving similar information could lead them to copy the behavior or show identical or similar behavior.

In addition, according to this research studied, we can conclude that the behavioral change processes of both techniques were the specific characteristics to choose apply using with the different criteria.

The BBS technique selection criteria are as follows:

- The appropriate BBS technique applied to the factory that have already been good in safety management with safety standards but the workers still to lack of awareness and not participated in safety aspect.

- The BBS technique selection, at-risk behaviors or unsafe acts in work place must be identified to select target behaviors to be changed according to the behavioral change process. In this way, the workers are assigned the responsibility and authority to identify, defining and monitoring their safe and unsafe behaviors, as well as setting personal "safety improvement" targets. For that reason, the BBS technique is more appropriate to responsible and experienced workers more than new workers

- The BBS technique required the workers participation. Thus, should be considering applying this technique to the workers who have good relationship among group to achieve the behavioral change process.

The PMT technique selection criteria are as follows:

- The PMT technique prefers to apply using with inexperienced workers group or a person who lack of motivation to change the behaviors in order to prepare and create a positive attitude for the behavioral change.

- The activities in the PMT technique have got several characteristics and multiple purposes. Hence, the relationship creation among workers group is needed to persuade the participation from the workers, ice break activity in order to create the familiar within group and to support the behavioral change process for more efficiency.

- The PMT technique was the combination of psychology and behavior science that contribute to the perception of the person to the change in behaviors. This technique requires constant stimulation through the knowledge providing and social support. Therefore, the PMT technique required reasonable period of the program implementation in order to make the technique successful.

CHAPTER VI
CONCLUSION

6.1 Conclusion

The study of the changes in target safety behaviors by applied the behavioral change process between the Behavior Based Safety (BBS) and the Protection Motivation Theory (PMT) techniques among the polishing workers. The workers were divided into two groups: BBS and PMT groups. The programs were implemented for 12 weeks, and the data were collected by using self-administered questionnaire and the behaviors observation form. The results of this study can be concluded as the following:

6.1.1 Knowledge and attitudes regarding safety at work before and after the BBS technique implementation were significantly different, while safety behaviors were not significantly different.

6.1.2 Target safety behaviors before and after the BBS technique implementation was significantly different.

6.1.3 Knowledge, attitudes and behaviors regarding safety at work before and after the PMT technique implementation were not significantly different.

6.1.4 Target safety behaviors before and after the PMT technique implementation was significantly different.

6.1.5 Knowledge, attitudes and behaviors regarding safety at work before and after program implementation between the BBS and the PMT techniques were not significantly different.

6.1.6 Target safety behaviors before and after program implementation between the BBS and the PMT techniques were not significantly different.

6.2 Recommendations for the study are as follows:

6.2.1 The quasi experimental research studied the result of the safety behaviors changed by measured results of the change within 3 months of the program implementation. Therefore, if the sustainable safety behaviors of the workers are required, the behaviors modification followed up program must be included with periodic retraining at least one per month. In addition, the sustainable safety behaviors should extend to the entire organization.

6.2.2 The questionnaire was used to assess knowledge, attitudes and behaviors regarding safety at work. Recommended to develop the degree of difficulty of the query higher than a basic or general knowledge of the workers.

6.2.3 Recommended the two way communications between management, leaders and workers in order to promote safety behaviors.

6.3 Recommendations for future study are as follows:

6.3.1 For further study, it is recommended that social factors such as social support and social influence which have the potential affect to safety behavioral change should be included.

6.3.2 For further study, the results of behavior modification program should be included. It is advised that the study should be divided into three phases including before, during and after program implementation. The after program implementation should comply with the following i.e., one month, two months and three months after program implementation in order to study on the behavior modification program efficiency for safe behaviors sustainable of both techniques.

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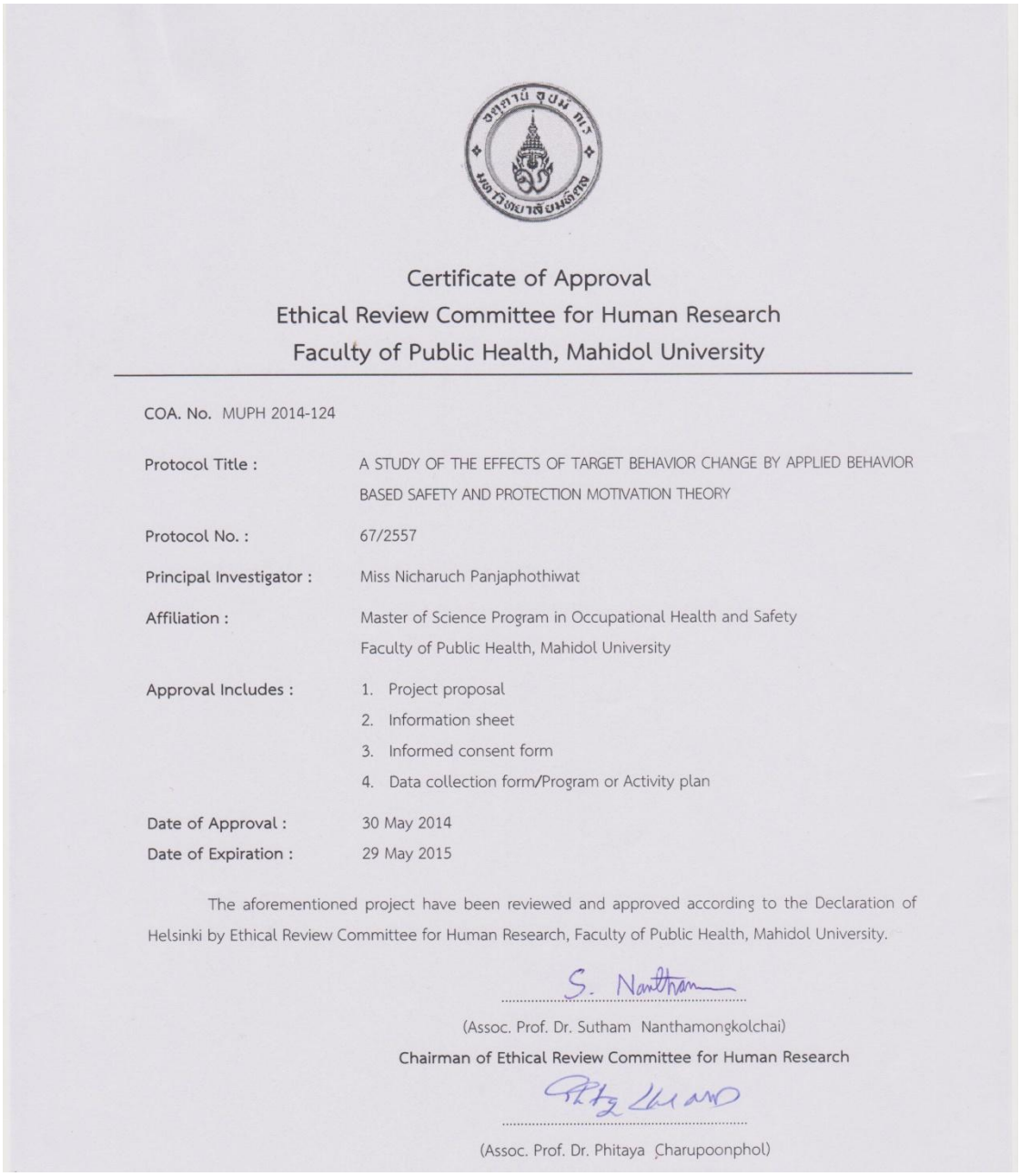
APPENDICES

APPENDIX A
DOCUMENTARY PROOF OF ETHICAL CLEARANCE



Certificate of Approval
Ethical Review Committee for Human Research
Faculty of Public Health, Mahidol University

COA. No. MUPH 2014-124

Protocol Title :	A STUDY OF THE EFFECTS OF TARGET BEHAVIOR CHANGE BY APPLIED BEHAVIOR BASED SAFETY AND PROTECTION MOTIVATION THEORY
Protocol No. :	67/2557
Principal Investigator :	Miss Nicharuch Panjaphothiwat
Affiliation :	Master of Science Program in Occupational Health and Safety Faculty of Public Health, Mahidol University
Approval Includes :	1. Project proposal 2. Information sheet 3. Informed consent form 4. Data collection form/Program or Activity plan
Date of Approval :	30 May 2014
Date of Expiration :	29 May 2015

The aforementioned project have been reviewed and approved according to the Declaration of Helsinki by Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University.

S. Nanthamongkolchai

(Assoc. Prof. Dr. Sutham Nanthamongkolchai)
Chairman of Ethical Review Committee for Human Research

(Assoc. Prof. Dr. Phitaya Charupoonphol)

A.1 Documentary proof of ethical clearance of faculty of Public Health, Mahidol University

APPENDIX B
QUESTIONNAIRE

แบบสอบถาม

เรื่อง การศึกษาผลของการปรับเปลี่ยนพฤติกรรมเป้าหมาย ด้วยวิธีการปรับเปลี่ยนพฤติกรรมเพื่อความปลอดภัย (Behavior Based Safety: BBS) และ ด้วยทฤษฎีแรงจูงใจเพื่อการป้องกัน (Protection Motivation Theory: PMT)

<u>คำชี้แจง</u>

แบบสอบถามนี้มีวัตถุประสงค์ในการจัดทำขึ้นเพื่อสำรวจและเก็บข้อมูลเกี่ยวกับทัศนคติ ความรู้ และพฤติกรรมความปลอดภัยในการทำงาน ข้อมูลทั้งหมดที่ได้จากการตอบแบบสอบถามนี้จะถือเป็นความลับ และจะไม่มีผลกระทบใดๆต่อการปฏิบัติงานของท่าน ดังนั้นจึงขอความกรุณาท่านในการตอบแบบสอบถามแต่ละข้อตามกับความคิดเห็นและความรู้สึกของท่านที่ตรงความเป็นจริงที่สุด เพื่อประโยชน์ทางด้านวิชาการ และใช้เป็นแนวทางในการป้องกันอุบัติเหตุจากการทำงาน

แบบสอบถาม ชุดนี้แบ่งออกเป็น 4 ส่วน ดังนี้

ส่วนที่ 1 แบบสอบถามเกี่ยวกับข้อมูลทั่วไป	จำนวน 6 ข้อ
ส่วนที่ 2 แบบสอบถามเกี่ยวกับความรู้ด้านความปลอดภัย	จำนวน 15 ข้อ
ส่วนที่ 3 แบบสอบถามเกี่ยวกับทัศนคติความปลอดภัย	จำนวน 15 ข้อ
ส่วนที่ 4 แบบสอบถามเกี่ยวกับพฤติกรรมความปลอดภัย	จำนวน 20 ข้อ

การวิจัยนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ ในหลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาอาชีวอนามัยและความปลอดภัย คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล

ผู้วิจัยขอขอบพระคุณท่านเป็นอย่างสูงที่ได้กรุณาสละเวลาในการกรอกแบบสอบถามมา ณ โอกาสนี้

นางสาวณิชารัศม์ ปัญจโพธิวัฒน์

ผู้ทำวิจัย

แบบสอบถามเรื่องพฤติกรรมความปลอดภัย

รหัสพนักงาน.....

<u>ส่วนที่ 1</u> แบบสอบถามข้อมูลทั่วไป

<u>คำแนะนำ</u> โปรดเติมข้อความลงในช่องว่างหรือทำเครื่องหมาย √ ลงใน ☐ หน้าข้อความที่ตรงกับความเป็นจริงของท่าน

1. เพศ ☐ ชาย ☐ หญิง

2. อายุ.....ปี

3. ระดับการศึกษา

☐ ประถมตอนต้น ☐ ประถมตอนปลาย ☐ มัธยมศึกษาตอนต้น

☐ มัธยมศึกษาตอนปลาย / ปวช. ☐ อนุปริญญา / ปวส. ☐ ปริญญาตรี

☐ อื่นๆ โปรดระบุ.....

4. ประสบการณ์การทำงาน/อายุงาน (ในตำแหน่งปัจจุบัน) ..... ปี

5. ท่านเคยได้รับประสบการณ์การเข้าอบรมเกี่ยวกับความปลอดภัยในการทำงาน

☐ ไม่เคย ☐ เคย เรื่องที่ได้รับการอบรม

……

……

6. ประสบการณ์การได้รับอุบัติเหตุเนื่องจากการทำงาน

☐ ไม่เคย ☐ เคย เนื่องจาก

……

……

<u>ส่วนที่ 2</u> แบบสอบถามเกี่ยวกับความรู้ด้านความปลอดภัย

<u>คำแนะนำ</u> โปรดทำเครื่องหมาย √ ลงใน ☐ หน้าข้อความที่ตรงกับความคิดเห็นของท่านมากที่สุด

ข้อคำถาม	คำตอบ		
	ใช่	ไม่รู้ / ไม่แน่ใจ	ไม่ใช่
1. สาเหตุสำคัญของการเกิดอุบัติเหตุ มีสาเหตุมาจากการกระทำที่ไม่ปลอดภัย เช่น มีหมวกกันน็อค แต่ไม่สวมใส่ขณะขับขี่รถจักรยานยนต์			
2. หัวใจสำคัญของการป้องกันอุบัติเหตุ คือ การป้องกันที่สภาพการณ์ที่ไม่ปลอดภัย			
3. ห้ามปฏิบัติงานในที่ลับตาผู้คนเพียงคนเดียว โดยไม่มีใครทราบ โดยเฉพาะการทำงานหลังเวลาการทำงานปกติ			
4. ในขณะทำงานเกิดมีเสียงดังจากเครื่องจักรที่ทำงานผิดปกติ ให้ทำงานต่อแล้วค่อยหยุดตรวจสอบในภายหลัง			
5. การจัดเก็บวัตถุไวไฟ จะต้องจัดเก็บอยู่ในภาชนะที่มีฝาปิดสนิท แยกออกจากวัตถุไวไฟประเภทอื่น โดยต้องติดตั้งป้ายเตือนให้เห็นอย่างชัดเจน			
6. กฎความปลอดภัยในการทำงานบังคับใช้ปฏิบัติกับทุกคน ทั้งผู้บริหาร หัวหน้างาน และพนักงาน			
7. การถอยหลังรถจอดเข้าซองในที่จอดรถถือว่าเป็นวิธีการปฏิบัติที่ไม่ปลอดภัย			
8. สวิตซ์ไฟฟ้าที่แตกหรือชำรุดสามารถทำงานอย่างปลอดภัยได้ ถ้าท่านระมัดระวังตลอดเวลา			
9. การติดตั้งการ์ดนิรภัยให้กับเครื่องจักร มีไว้เพื่อห่อหุ้ม และปิดกั้นจุดอันตรายของเครื่องจักรไม่ให้มีการสัมผัสกับผู้ปฏิบัติงานโดยตรง			
10. การทำงานที่เกี่ยวข้องกับการสัมผัสฝุ่นนั้น ไม่จำเป็นต้องสวมใส่หน้ากากป้องกันฝุ่นในบริเวณที่มีการฟุ้งกระจายของฝุ่นน้อย			
11. เมื่อเห็นป้ายให้สวมใส่หมวกนิรภัยในบริเวณการทำงาน ถ้าขณะนั้นไม่มีการทำงานบนที่สูง ท่านสามารถสวมใส่หมวกนิรภัยหรือไม่ก็ได้			

ข้อคำถาม	คำตอบ		
	ใช่	ไม่รู้ / ไม่แน่ใจ	ไม่ใช่
12. ถ้าพบผู้ถูกไฟฟ้าช็อตต้องรีบช่วยให้พ้นจากกระแสไฟฟ้าก่อน แล้วจึงค่อยทำการตัดวงจรไฟฟ้า			
13. ในกรณีที่ต้องทำงานในสถานที่มืด ทึบ คับแคบ เช่น ในถ้ำ อุโมงค์ ต้องสวมใส่หมวกนิรภัยที่มีอุปกรณ์ส่องสว่าง หรืออุปกรณ์ส่องสว่างอื่นที่เหมาะแก่สภาพ และลักษณะของงาน			
14. การปฏิบัติงานในพื้นที่ ที่มีความเสี่ยงอันตรายสูง เช่น พื้นที่อับอากาศ ในอุโมงค์ และใต้น้ำจำเป็นต้องขอหนังสืออนุญาตให้ทำงาน (work permit) ก่อนจึงจะสามารถเข้าไปปฏิบัติงานได้			
15. หากพบเห็นสภาพการทำงานที่ไม่ปลอดภัย หรือเครื่องมือเครื่องใช้ชำรุดไม่อยู่ในสภาพที่ปลอดภัย ถ้าแก้ไขด้วยตนเองได้ให้ดำเนินการแก้ไขทันที หากแก้ไขไม่ได้ ให้รายงานให้ผู้บังคับบัญชารับทราบโดยเร็ว			

<u>ส่วนที่ 3</u> แบบสอบถามเกี่ยวกับทัศนคติความปลอดภัย

<u>คำแนะนำ</u> โปรดทำเครื่องหมาย √ ลงใน ☐ หน้าข้อความที่ตรงกับความคิดเห็นของท่านมากที่สุด

ข้อคำถาม	ระดับความเห็น				
	เห็นด้วยมากที่สุด	เห็นด้วยมาก	เห็นด้วยปานกลาง	เห็นด้วยน้อย	ไม่เห็นด้วย
1. การปฏิบัติตามกฎระเบียบด้านความปลอดภัยอย่างเคร่งครัดสามารถป้องกันอุบัติเหตุได้					
2. การปฏิบัติงานตามขั้นตอนการทำงานทำให้ท่านปฏิบัติงานได้อย่างล่าช้า					
3. สภาพแวดล้อมในการทำงานที่ดี ไม่มีผลต่อการทำงานที่ปลอดภัย					
4. การสวมใส่อุปกรณ์ป้องกันอันตรายส่วนบุคคล ทำให้ท่านรู้สึกอึดอัด ไม่สะดวกในการทำงาน					
5. ไม่มีความจำเป็นต้องสวมใส่อุปกรณ์ป้องกันอันตรายส่วนบุคคล หากท่านปฏิบัติงานด้วยความระมัดระวังเพียงพอ					
6. การดูแลความปลอดภัยให้แก่ผู้ร่วมงานสามารถป้องกันการเกิดอุบัติเหตุได้					
7. ไม่มีความจำเป็นต้องคอยระวัง และใส่ใจเรื่องความปลอดภัย เพราะความปลอดภัยเป็นหน้าที่ของเจ้าหน้าที่ความปลอดภัย					
8. การเกิดอุบัติเหตุเป็นเรื่องของโชคชะตาและเคราะห์กรรมของแต่ละคน					
9. เครื่องราง ของขลัง สามารถช่วยให้ท่านแคล้วคลาดจากอุบัติเหตุได้					

ข้อคำถาม	ระดับความเห็น				
	เห็นด้วยมากที่สุด	เห็นด้วยมาก	เห็นด้วยปานกลาง	เห็นด้วยน้อย	ไม่เห็นด้วย
10. การตรวจสอบอุปกรณ์ เครื่องมือเครื่องจักรก่อนเริ่มทำงานสามารถป้องกันอุบัติเหตุได้					
11. การใช้เครื่องมือ และอุปกรณ์ที่ชำรุดหรือไม่เหมาะสมกับลักษณะงานเป็นสาเหตุหนึ่งของการเกิดอุบัติเหตุจากการทำงาน					
12. การเรียนรู้ถึงสาเหตุการเกิดอุบัติเหตุในอดีต จะช่วยให้ท่านสามารถป้องกันอุบัติเหตุในอนาคตได้					
13. การเกิดอุบัติเหตุเป็นเรื่องที่ไม่สามารถป้องกันได้					
14. การปฏิเสธการทำงานในส่วนที่ไม่มีหน้าที่เกี่ยวข้อง หรือไม่มีความชำนาญสามารถป้องกันอุบัติเหตุได้					
15. การสอบสวนอุบัติเหตุที่ไม่มีผู้ใดได้รับบาดเจ็บ หรือมีการเสียหายของทรัพย์สินเป็นการเสียเวลาโดยใช่เหตุ					

<u>ส่วนที่ 4</u> แบบสอบถามเกี่ยวกับพฤติกรรมความปลอดภัย

<u>คำแนะนำ</u> โปรดทำเครื่องหมาย √ ลงใน ☐ หน้าข้อความที่ตรงกับความคิดเห็นของท่านมากที่สุด

ข้อคำถาม	ระดับความถี่ของการปฏิบัติ				
	ปฏิบัติทุกครั้ง	ปฏิบัติบ่อยครั้ง	ปฏิบัติบางครั้ง	ปฏิบัตินานๆครั้ง	ไม่เคยปฏิบัติ
1. ท่านทำงานแทนผู้อื่น หรือทำงานในส่วนที่ไม่มีหน้าที่เกี่ยวข้อง และไม่มีความชำนาญ					
2. ท่านดื่มเครื่องดื่มมึนเมาหรือเครื่องดื่มผสมแอลกอฮอล์ก่อนทำงาน และดื่มในระหว่างเวลาทำงาน					
3. ท่านทำการซ่อมบำรุงเครื่องจักรหรืออุปกรณ์ในขณะมีการใช้งาน					
4. ท่านสวมใส่อุปกรณ์ป้องกันอันตรายส่วนบุคคลในการปฏิบัติงาน					
5. ท่านใช้อุปกรณ์ป้องกันอันตรายส่วนบุคคลไม่ถูกวิธี หรือไม่เหมาะสมกับลักษณะการใช้งาน					
6. ท่านตรวจสอบอุปกรณ์เครื่องมือ เครื่องจักรในการทำงานทั้งก่อนและหลังการปฏิบัติงาน					
7. ท่านคอยดูแล รักษาความสะอาดและความเป็นระเบียบเรียบร้อยของสถานที่ และบริเวณการทำงาน					
8. ท่านปฏิบัติงานตามขั้นตอนการปฏิบัติงาน และกฎระเบียบด้าน					

ข้อคำถาม	ระดับความถี่ของการปฏิบัติ				
	ปฏิบัติทุกครั้ง	ปฏิบัติบ่อยครั้ง	ปฏิบัติบางครั้ง	ปฏิบัตินานๆครั้ง	ไม่เคยปฏิบัติ
ความปลอดภัยของโรงงาน					
9. ท่านถอดเครื่องกำบังส่วนอันตรายของเครื่องจักรออกด้วยความรู้สึกรำคาญ ทำงานไม่สะดวก หรือถอดออกเพื่อซ่อมแซม แล้วไม่ได้ใส่คืน					
10. ท่านยังคงใช้เครื่องจักร หรืออุปกรณ์ที่ชำรุด หากพบว่าเครื่องจักร หรืออุปกรณ์ดังกล่าวยังสามารถใช้งานได้					
11. ท่านกล่าว ตักเตือนเพื่อนร่วมงาน เมื่อพบว่าเพื่อนร่วมงานกำลังเล่น หรือหยอกล้อกันในระหว่างปฏิบัติงาน					
12. ท่านกล่าว ตักเตือนเพื่อนร่วมงาน เมื่อพบว่าเพื่อนร่วมงานไม่ได้สวมใส่อุปกรณ์ป้องกันอันตรายส่วนบุคคลในขณะปฏิบัติงาน					
13. ท่านแนะนำ เพื่อนร่วมงานให้พักผ่อนให้เพียงพอ เมื่อพบว่าเพื่อนร่วมงานมีอาการง่วงซึมในขณะปฏิบัติงาน					
14. ท่านแนะนำให้เพื่อนร่วมงานปฏิบัติตามกฎระเบียบความปลอดภัยในการปฏิบัติงานอย่างเคร่งครัด					

ข้อคำถาม	ระดับความถี่ของการปฏิบัติ				
	ปฏิบัติทุกครั้ง	ปฏิบัติบ่อยครั้ง	ปฏิบัติบางครั้ง	ปฏิบัตินานๆครั้ง	ไม่เคยปฏิบัติ
15. ท่านคอยสังเกต และบ่งชี้จุดอันตรายของสภาพแวดล้อมในที่ทำงานให้เพื่อนร่วมงานรับทราบเพื่อป้องกันอันตรายที่อาจเกิดขึ้น					
16. ท่านกล่าว ชื่นชมเพื่อนร่วมงาน เมื่อพบว่าเพื่อนร่วมงานตรวจสอบความพร้อมของเครื่องมือ อุปกรณ์ในการทำงานทุกครั้งก่อนเริ่มปฏิบัติงาน					
17. ท่านกล่าว ตักเตือนเพื่อนร่วมงาน เมื่อพบว่าเพื่อนร่วมงานใช้อุปกรณ์ในการทำงานที่ชำรุดหรือไม่เหมาะสมกับลักษณะงาน					
18. ท่านคอยสังเกตพฤติกรรมการทำงานของเพื่อนร่วมงาน และบอกให้เพื่อนร่วมงานหยุดปฏิบัติงานทันที หากพบเห็นพฤติกรรมไม่ปลอดภัย					
19. ท่านกล่าว ชมเชยเพื่อนร่วมงาน เมื่อพบว่าเพื่อนร่วมงานปฏิบัติงานตามขั้นตอนการทำงาน					
20. ท่านแนะนำให้เพื่อนร่วมงานศึกษาคู่มือการใช้งานของเครื่องจักร และอุปกรณ์ชนิดใหม่หรือที่ไม่มีความชำนาญก่อนทุกครั้งที่จะเริ่มนำมาใช้งาน					

แบบประเมินความพึงพอใจของกิจกรรม

<u>คำแนะนำ</u> โปรดทำเครื่องหมาย √ ลงใน ☐ หน้าข้อความที่ตรงกับความคิดเห็นของท่านมากที่สุด

ข้อความ	ระดับความพึงพอใจ				
	มากที่สุดหรือดีมาก	มากหรือดี	ปานกลางหรือพอใช้	น้อยหรือต่ำ	น้อยที่สุดหรือควรปรับปรุง
1.ความเหมาะสมของเนื้อหาความรู้ที่ใช้ในการดำเนินกิจกรรม					
2.ความเหมาะสมของระยะเวลาในการดำเนินกิจกรรม					
3.ความเหมาะสมของวิทยากรในการดำเนินกิจกรรม					
4.ท่านได้รับความรู้ และประสบการณ์ใหม่ๆจากกิจกรรม					
5.ท่านสามารถนำสิ่งที่ได้จากกิจกรรมไปใช้ในการปฏิบัติงานได้					
6.ท่านสามารถนำกิจกรรมไปเผยแพร่และสอนให้กับผู้อื่นได้					
7.กิจรรมนี้เอื้ออำนวยต่อการเรียนรู้ และพัฒนาความสามารถของท่าน					
8.กิจกรรมนี้สามารถช่วยเพิ่มความปลอดภัยในการทำงานของท่าน					
9.ประโยชน์ที่ได้จากการเข้าร่วมกิจกรรม					
10.ความพึงพอใจของท่านต่อภาพรวมของกิจกรรม					
รวม					

APPENDIX C
THE RESULTS OF TARGET SAFETY BEHAVIORS ACCORDING TO THE PRIORITIZED SETTING

C.1 The target safety behaviors of the BBS target group

At-risk behavior	Safe behavior	Opinion (score)				Total score
		Size of problem	Severity	Feasibility	Worker concern	
1.Excessive noise	Wear ear plugs	2	4	5	5	42
2.Grinding dust	Wear mask	3	4	4	4	38
3. Falling object	Wear safety shoes	2	3	4	4	34

C.2 The target safety behaviors of the BBS target group

At-risk behavior	Safe behavior	Opinion (score)				Total score
		Size of problem	Severity	Feasibility	Worker concern	
1. Excessive noise	Wear plugs	2	5	5	5	44
2.Falling object	Wear safety shoes	2	4	5	4	39
3.Grinning dust	Wear mask	3	4	4	4	38

*Total score = (Nx2)+(Nx2)+(Nx3)+(Nx3)

APPENDIX D
BEHAVIORS OBSERVATION FORM

COTTO Share the World...Pleasure แบบบันทึกการสังเกตพฤติกรรมความปลอดภัยเป้าหมาย(BBS) ผู้สังเกต XX1 วันที่.....เวลา.....น		
พฤติกรรมเป้าหมาย	**ปฏิบัติ**	**ไม่ปฏิบัติ**
ผู้ถูกสังเกต A		
1.สวมใส่รองเท้าเซฟตี้		
2.สวมใส่อุปกรณ์ลดเสียง		
3.สวมใส่หน้ากากป้องกันฝุ่น		
ผู้ถูกสังเกต B		
1.สวมใส่รองเท้าเซฟตี้		
2.สวมใส่อุปกรณ์ลดเสียง		
3.สวมใส่หน้ากากป้องกันฝุ่น		
ผู้ถูกสังเกต C		
1.สวมใส่รองเท้าเซฟตี้		
2.สวมใส่อุปกรณ์ลดเสียง		
3.สวมใส่หน้ากากป้องกันฝุ่น		

APPENDIX E
THE PERCENTAGE OF SAFE BEHAVIOR OF EACH TARGET SAFETY BEHAVIORS IN THE BBS AND THE PMT TARGET GROUPS

E.1 Percentage of safe behavior of each target safety behavior in the BBS target group

Target safety behavior	Percentage of safe behavior (per week)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. Wear safety shoes	80.00	89.33	98.89	93.90	94.00	94.00	90.00	96.75	88.60	95.42	98.67	100
2. Wear ear plugs	96.67	98.71	100	99.60	100	100	100	100	95.07	99.62	100	100
3. Wear mask	90.00	97.23	91.44	92.27	64.00	97.00	56.00	99.50	93.17	97.53	100	100
Average result	**88.89**	**95.09**	**96.78**	**95.26**	**86.00**	**97.00**	**82.00**	**98.75**	**92.28**	**97.52**	**99.56**	**100**

E.2 Percentage of safe behavior of each target safety behavior in the PMT target group

Target safety behavior	Percentage of safe behavior (per week)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. Wear safety shoes	83.33	84.67	88.01	80.85	94.89	100	100	85.12	93.94	86.88	94.23	94.50
2. Wear ear plugs	100	91.22	95.90	98.82	100	100	100	99.50	97.33	97.50	99.60	100
3. Wear mask	94.45	90.33	87.50	85.22	93.72	98.00	91.33	94.95	98.00	95.50	98.40	100
Average result	**92.59**	**88.74**	**90.47**	**88.30**	**96.20**	**99.30**	**97.11**	**93.19**	**96.43**	**93.29**	**97.41**	**98.17**

APPENDIX F

THE PERCENTAGE OF SAFE BEHAVIOR OF EACH SUBJECT IN THE BBS AND THE PMT TARGET GROUPS

Number	Name	Week												%Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1	A	55.56	95.56	96.30	93.33	76.67	100.00	73.33	100.00	81.33	97.22	100.00	100.00	99.86
2	B	100.00	97.92	100.00	100.00	96.67	100.00	66.67	100.00	93.33	98.61	100.00	100.00	99.69
3	C	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.67	100.00	100.00	100.00	87.10
4	D	83.33	68.89	81.48	76.00	50.00	83.33	66.67	92.86	76.00	83.33	97.78	100.00	100.00
5	E	100.00	97.78	100.00	100.00	100.00	100.00	73.33	100.00	95.83	100.00	100.00	100.00	98.58
6	F	88.89	100.00	100.00	89.33	100.00	90.00	66.67	98.33	92.75	98.61	100.00	100.00	98.90
7	G	100.00	97.44	100.00	98.55	100.00	100.00	100.00	100.00	100.00	97.44	100.00	100.00	97.27
8	H	83.33	100.00	100.00	100.00	100.00	100.00	100.00	100.00	96.67	100.00	100.00	100.00	82.40
9	I	77.78	93.33	90.00	90.00	66.67	96.67	73.33	96.30	95.65	100.00	97.78	100.00	87.67
10	J	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	91.67	100.00	100.00	100.00	91.40
		88.89	**95.09**	**96.78**	**94.72**	**89.00**	**97.00**	**82.00**	**98.75**	**92.19**	**97.52**	**99.56**	**100.00**	

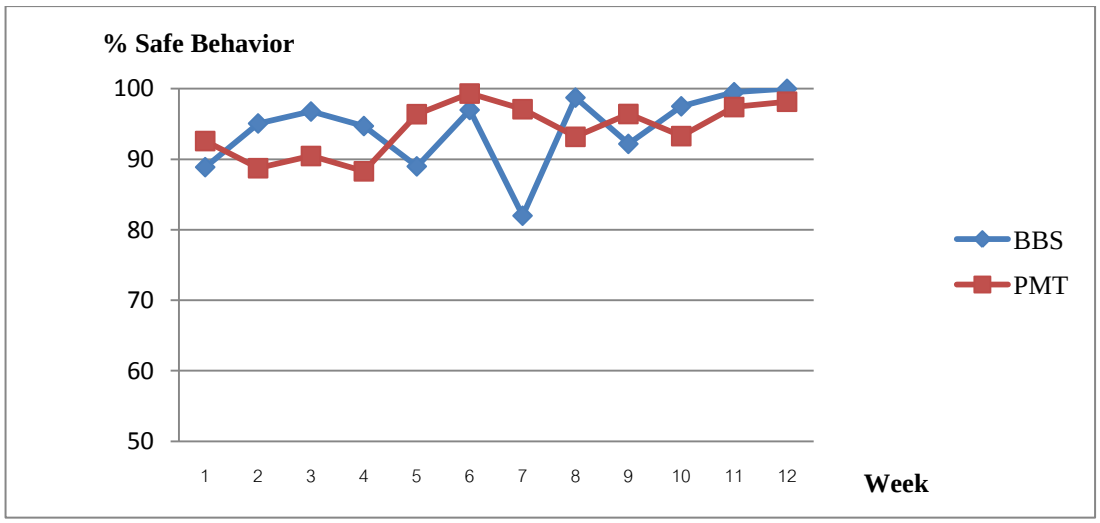
F.1 percentage of safe behavior of each subject in the BBS target group

Number	Name	Week												%Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1	A	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.33	100.00	100.00	100.00	100.00	89.11
2	B	100.00	96.30	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	96.10
3	C	77.78	53.33	83.33	88.89	98.15	100.00	100.00	78.33	95.40	82.22	92.75	95.00	99.89
4	D	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	79.97
5	E	100.00	100.00	100.00	94.12	100.00	100.00	100.00	90.00	98.85	100.00	100.00	100.00	97.25
6	F	88.89	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	97.92	100.00	100.00	93.72
7	G	96.30	100.00	94.44	100.00	100.00	100.00	100.00	98.33	87.78	91.67	98.67	100.00	99.45
8	H	81.48	66.67	63.89	50.00	88.89	100.00	77.78	87.72	100.00	83.33	97.33	91.67	98.33
9	I	88.89	77.78	76.92	70.59	88.67	100.00	93.33	89.58	86.67	88.89	90.67	100.00	89.79
10	J	92.59	93.33	86.11	79.37	88.33	93.33	100.00	89.58	95.56	88.89	94.67	95.00	99.31
		92.59	**88.74**	**90.47**	**88.30**	**96.40**	**99.33**	**97.11**	**93.19**	**96.43**	**93.29**	**97.41**	**98.17**	

F.2 percentage of safe behavior of each subject in the PMT target group

APPENDIX G

WEEKLY CONCLUSION PERCENTAGE OF SAFE BEHAVIOR REPOST OF THE BBS AND THE PMT TARGET GROUPS



G.1 Weekly conclusion percentage of safe behavior report

APPENDIX H
THE RESULT OF THE SATISFACTION EVALUATION OF THE BEHAVIORAL CHANGE PROCESS THROUGH THE BBS AND THE PMT TECHNIQUES

H.1 Result of the satisfaction evaluation of the behavioral change process through the BBS technique (n=10)

Satisfaction	Mean	S.D.	Interpretation
1. The appropriateness of the knowledge content that use in the activities.	4.90	0.31	highly satisfied
2. The appropriateness of the program duration.	4.50	0.52	highly satisfied
3. The suitability of the speakers in the activities.	4.60	0.51	highly satisfied
4. You get knowledge and new experiences from the activities.	4.90	0.31	highly satisfied
5. You can bring the benefits from the activities to apply for your work.	4.80	0.42	highly satisfied
6. You can bring this activity to share with others.	4.40	0.51	highly satisfied
7. This activity conducive to learning and improve your abilities.	4.90	0.31	highly satisfied
8. This activity can improve your safety at work.	5.00	0.00	highly satisfied
9. The benefits from the participation.	4.80	0.42	highly satisfied
10. The satisfaction of the overall activity.	4.90	0.31	highly satisfied

H.2 Result of the satisfaction evaluation of the behavioral change process through the PMT technique (n=10)

Satisfaction	Mean	S.D.	Interpretation
1. The appropriateness of the knowledge content that use in the activities.	4.70	0.48	highly satisfied
2. The appropriateness of the program duration.	4.60	0.51	highly satisfied
3. The suitability of the speakers in the activities.	4.80	0.42	highly satisfied
4. You get knowledge and new experiences from the activities.	4.60	0.51	highly satisfied
5. You can bring the benefits from the activities to apply for your work.	4.70	0.48	highly satisfied
6. You can bring this activity to share with others.	4.80	0.42	highly satisfied
7. This activity conducive to learning and improve your abilities.	4.70	0.48	highly satisfied
8. This activity can improve your safety at work.	4.90	0.31	highly satisfied
9. The benefits from the participation.	4.70	0.48	highly satisfied
10. The satisfaction of the overall activity.	4.90	0.31	highly satisfied

BIOGRAPHY

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