The Effects of Individual Behavioral Counseling on the Attitudes to Work Safety of Thai Power Plant Workers

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Abstract. *The purpose of this research was to study the effect of individual behavioral counseling on power plant workers' attitudes to occupational safety behavior. The sample used in this study consisted of 32 power plant workers, who were randomly divided into two groups. One group was the experimental group, which received an individual behavioral counseling program in 10 weekly sessions and the other was the control group, which received no treatment. The instruments used in this study was the Occupational Safety Behavior of Power Plant Worker Inventory and the Individual Behavioral Counseling Program was designed by the researcher. The data collecting procedure was carried out in three phases: the 'Pre-test', the 'Post-test' and the 'Follow-up'. Data were analyzed by repeated measures analysis of variance: one between-subjects variable and one within-subjects variable, and a paired-difference test using the Newman-Keuls procedure. The results of the study indicated that there was a statistically significant interaction at the .05 level between the treatment method and the phase of experiment. The power plant workers in the experimental group had higher mean scores in occupational safety behavior than those in the control group in the Posttest and Follow-up phases, while there was no statistically significant difference between the two groups at the Pretest. It was concluded that the counseling program had made a difference to the work safety attitudes of the workers who had received this intervention.*

Keywords: Occupational Safety Behavior, Individual Counseling, Behavior Counseling, Power Plant Workers

Introduction

Industrial development in Thailand has been greatly promoted and this has led to significant economic growth. The increase in the variety of industrial plants has created dangers from their production processes and from their working conditions. Reference to the occupational injury and illness annual report from the worker's compensation fund of the social security department indicated that the severe occupational injury and illness rate has been increasing continuously (Social Security Office, 2011). Thailand's electrical power supplies are a vital resource in meeting the industrial needs of the country every day. The BLCP power plant is an independent power plant, which is located on the Map Ta Phut industrial estate, Rayong. It has 280 employees working in operations, maintenance and other supporting sections. Power plant workers have to contend with working under hazardous working conditions, such as noise, dust and the inherent dangers of electrical apparatus. The BLCP power plant had 45 near miss reports and 2 incidents in 2008, and 94 near miss reports with 3 incidents recorded in 2009.The workers suffered from their injuries and the company bore their losses (BLCP Safety & Health Department, 2009). There have been severe incidents in other power plants. A power plant explosion in the USA killed 5 workers and injured 12 others (Post Today, 2010). In 2009, an accident at the Sayano–Shushenskaya hydroelectric power plant in Russia caused the death of 12 workers and left 70 workers missing. This incident caused the widespread loss of electricity supplies to a large area (Manager online, 2009).

Occupational accidents can create enormous losses, which can be measured in terms of the physical and economic impact upon workers and their families and also on their colleagues and

the company. There is, therefore, an incentive to minimize and eradicate occupational accidents. A study to find out the root cause of occupational accidents found that 88% of all industrial accidents are caused by unsafe behavior of workers, 10% by equipment failure and 2% by "acts of God", as was the case with the power plant accidents at the plant in the USA and with the Sayano–Shushenskaya hydroelectric power plant accident in Russia. Investigations found that the root cause of these accidents was workers' unsafe behavior or an unsafe workplace created by workers. In the case of the BLCP power plant in Thailand, an accident investigation also found that the root cause of accidents was workers' unsafe behavior and an unsafe workplace created by workers. From the above occupational accident cases it can be concluded that the main cause of occupational accidents is workers' unsafe behavior or an unsafe workplace created by workers. Both the failure of occupational safety behavior and the creation of unsafe working areas can be caused by neglecting safety rules, by a lack of safety awareness, using unsuitable tools and equipment, and a failure to prepare the body and mind for work, leading to a poor safety attitude. The above finding is in line with studies on accident factors which found that workers' unsafe behavior was the root cause of occupational accidents (Gatetim, 1999; Hansuwan, 2002; Thawonsujaritkul, 2003; Yodkham, 2004; Phatarabuddha & Suwannarat, 2007).

According to accident chain theory, occupational accident prevention should mainly focus on correcting workers' unsafe behavior. The principle of accident chain theory, developed by Heinrich (1959), states that injury or damage is the consequence of accidents which result from unsafe behavior or unsafe workplaces. If unsafe behavior or unsafe workplace is eliminated, accidents should not occur. The principle of the accident chain theory was supported by Petchpud (1998), Thanjitprem & kwaamdee (2000), Thai Academic eBooks (2001), and Wonganutaroj (2005), who state that occupational accident prevention can be achieved by eliminating unsafe behavior or an unsafe workplace and occupational accident prevention should focus on changing workers' unsafe behavior into safe behavior. (Bhantumnavin, 2000, cited in Wiriya, 2008)

The reluctance to change behavior can be overcome successfully by applying suitable techniques, such as behavior modification, behavior therapy and counseling. Counseling is the most common method successfully applied to change human behavior. For example, Yongnoywong (2008) applied behavioral group counseling to develop the psychomotor domain of the life skills of students; Mamoon (2009) applied behavioral group counseling to reducing physically and verbally aggressive behavior of students; Prasertsan (2005) applied behavioral individual counseling to behavioral self-control to reduce the weight of obese adolescents. Counseling is the process of the relationship between the counselor, who has the knowledge, experience and skill, to direct a counselee, who may need help to understand his behavior and interaction with others and his environment, to enhance decision making, problem solving and self-development (Chatsupakul, 2004). There are two types of counseling: group counseling and individual counseling. Individual counseling is the process of cooperation between one counselor and one counselee to help the counselee to understand the problem and to solve the problem by him- or herself (Pupatpong, 2000). In the counseling process, the counselor utilizes counseling theory and techniques that are suitable for the counselee's problems (Chatsupakul, 2004).

Behavioral counseling is the counseling process using learning theory and techniques to encourage the counselee to find the way to eliminate an unwanted behavior and learn to create new, wanted behavior (Pongsopa, 2000). Learning theory, such as classical conditioning learning theory, operant conditioning learning theory and modeling learning theory is applied in behavioral counseling. Behavioral counseling using operant conditioning learning theory was developed by the American psychologist, B.F. Skinner, and is based on the belief that human behavior is the consequence of people's relationship with their environment and that human behavior can be changed by consequences occurring in the environment (Iamsupasit, 2007). The belief can be explained by the behavioral Model (ABC Model): Human behavior (B) is caused by stimulus (A) and creates the consequence (C). Two types of consequence consist of satisfied consequence (C^+) and unsatisfied consequence (C^-). Getting satisfied consequence (C^+) from performing behavior causes the person to repeat such behavior in the future, while getting unsatisfied consequence (C^-) from performing

behavior causes him/her to reduce such behavior in the future (Spiegler & Guevremont, 2003). Behavioral counseling applies learning theory based techniques, such as behavior assessment (ABC model), contingency management, and self control, for counselees to creates the logical thinking used for the careful analysis and understanding of the relationship between a stimulus and its consequence (Supmee, 2008). There are studies on the effect of using behavior counseling which have found that behavior counseling could change various unwanted behaviors of different persons into wanted behaviors. Examples are the development of safety values at work for the first year students of a technical college (Athipattayakul, 1997), promoting safety at work operations behavior of operators in industries (Rorung, 2003), reducing the smoking behavior of residents on probation (Panyawuttiwong, 1994), reducing impolite speaking behavior of students (Boonsanay, 2000), promoting health behavior of post-menopausal women (Uerpongsathon, 2003), promoting self control behavior to reduce the weight of adolescent obesity (Prasertsan, 2005), and the developing the psychomotor domain of life skills of student s(Yongnoywong, 2008).

Hypotheses

There were six hypotheses of this study:

1. There is interaction between method and phase of the experiment;
2. At the post-test phase, power plant workers who received behavior individual counseling will have a higher occupational safety behavior score than power plant workers who worked normally;
3. At the follow-up phase, power plant workers who are given behavior individual counseling will have higher occupational safety behavior score than power plant workers who worked normally;
4. At the post-test phase, power plant workers who are given behavior individual counseling will have higher occupational safety behavior score than before being given treatment;
5. At the follow-up phase, power plant workers who are given behavior individual counseling will have higher occupational safety behavior score than before being given treatment; and
6. There is no difference in occupational safety behavior score of power plant workers who are given behavior individual counseling at the post-test and the follow-up phases.

Definitions of Terms

Occupational Safety Behavior is the act, thoughts and feelings in the working condition reflecting conditions which are safe or no danger, injury, risk and losses. It consists of external occupational safety behavior which refers to the worker's safe act which can be easily observed by another, and internal occupational safety behavior which refers to the safe thoughts and feelings concerned with the safety which cannot be observed or are difficult to be observed by another.

Individual Behavioral Counseling is the individual helping process between one counselor and one counselee with the object to help the counselee to change unwanted behavior into wanted behavior by applying basic counseling skills and Skinner's learning theory principles. It is based on techniques such as the ABC model behavior assessment, contingency management and self-control.

Operation and Maintenance Workers in Power Plants are persons or employees who work in power plants. They have the responsibility of controlling, monitoring and maintaining equipment for generating electric power in a power plant where they have to work directly in the hazardous working conditions of heat, steam, electricity, noise, dust and chemical substance, all of which can cause accidents if workers do not observe occupational safety behavior.

Participants and Method

The subjects for this study were 280 power plant workers who were working in the BLCP power plant. The participants consisted of operations and maintenance workers. After the pretest, thirty-two participants volunteers and were randomly sampled from forty-one BLCP power plant worker who had an occupational safety behavior score lower than mean minus one standard deviation. They were randomly assigned into two groups, sixteen for the experimental group and sixteen were in the control group.

The study used the pretest-posttest control group design to study the effect of behavior individual counseling on power plant workers' occupational safety behavior. Prior to the initial commencement of the behavior individual counseling program, all participants signed an informed consent agreement. The experimental group participated in the behavior individual counseling program that was held one session *per* week for ten consecutive weeks. The control group received no treatment. After completion of the treatment, both the experimental and the control group completed the posttest assessment. Finally, power plant workers in both the experimental and control group were followed up two weeks after the end of the treatment.

Limitations of the Study

The control group received no treatment and, therefore, a Hawthorne Effect may have contributed to the significant findings

Instruments

1. **Occupational Safety Behavior Inventory** used in this study was developed from "The safety attitude test" (Jirachaiyabhas, 1998) and "The operational employees' perceptions on safety management and behaviors inventory" (Kaewchaithiam, 2005). In this study comparisons could be made of the effectiveness of behavioral individual counseling programs. This study used a 50-item self-report questionnaire in which participants rated themselves using a 4-point Likert scale ranging from (1= not at all) to (4 = very true). The Occupational Safety Behavior inventory was totaled for overall occupational safety behavior score and could be used as two subscales: 1) Internal occupational safety behavior; and 2) External occupational safety behavior. Each of the subscales consisted of 25 items. The two subscales were weighted on 25-100 scale and combined for a composite scale of 50-200 for total occupational safety behavior. The total scale internal consistency coefficient was .977 as measured by Cronbach's Alpha technique.

2. The Behavior Individual Counseling Program contained 10 consecutive sessions, each lasting 50 minutes. The procedure of each session included an introduction of the session goal, Skinner's learning theory based- technique educating, particle, homework assignment and feedback sharing. The summary of the protocol is presented in Table 1.

Table 1. Summary of protocol for each counseling session

Session	Contents
1-2	Rapport, objects presentation, informing counselee about counseling program,
3	Assessment and record counselee occupational unsafe behavior level, education counselee about accident theory and make them aware of accident impact.
4	Interview counselee to find their internal needs, use contingency contracting technique to engage counselee with their developing occupational safety behavior.
5	Education counselee about behavioral analysis (ABC model), apply ABC model to analysis the occupational unsafe behavior to find out stimulus and consequence.
6-9	Make action plan by using learning based-theory such as behavioral analysis (ABC model), contingency management technique and self-control technique, implement action plan in working environment, follow up efficient and progress of action plan, use implementation feedback to improve continuously action plan
10	Encourage counselee using self control technique for continuously developing their occupational safety behavior.

Procedure

The study was carried out in three separate, but interconnected phases, pretest, posttest and follow-up test, as described below.

Phase 1: Pretest phase. In this phase the occupational safety behavior inventory was administered to 280 BLCP's power plant workers and 32 of them with a low level of occupational safety behavior who volunteered were sampled randomly into two groups, the control group and the experimental group.

Phase 2: Posttest phase. This phase consisted of applying the behavior individual counseling program to improve occupational safety behavior. The behavior individual counseling program contained 10 sessions for 50 minutes, once a week. Each counseling session was carried out each week – on Tuesday to Friday in the BLCP power plant. The individual behavior counseling program consisted of establishing a relationship, assessment of unsafe behavior, identifying the stimulus and the consequences of unsafe behavior - learning the certain short-term consequences of unsafe behavior and training to manage the certain short-term consequences of unsafe behavior. After completing all counseling sessions, the occupational safety behavior inventory was administered in two groups.

Phase 3: Follow-up test phase. Two weeks after the end of the treatment, the Occupational Safety Behavior Inventory was administered in two groups again.

Data Analysis

The data collected were analyzed by calculating Means and Standard deviation of the treatment group and the control group. A One-way ANOVA: Repeated-Measures Analysis of Variance: One between-Subject Variable and One within-Subjects Variable (Howell, 2007) and Newman-Kuels Method were conducted for testing the research hypotheses.

Results

Table 2. Result of repeated-measures ANOVA on occupational safety behavior score by the treatment method and the duration of experiment.

Source of Variation	df	SS	MS	F	p
Between subject	31	5205.74			
Group (G)	1	698.76	698.76	4.65*	<.05
SS w/ in groups	30	4506.98	150.23		
Within subjects	64	2984.00			
Interval	2	1409.90	704.95	140.00*	<.001
I XG	2	1284.40	642.20	133.00*	<.001
IxSS w/in groups	60	289.71	4.83		
Total	95	8189.74			

*p < .05

Table 2 shows that there was a statistically significant interaction at the .05 level between the method and the duration of experiment. Power plant workers' occupational safety behavior score at the pre-test phase, post-test phase and follow- up phase were different with a statistical significance at the .05 level. Power plant workers' average occupational safety behavior scores in the experimental group and the control group were different with a statistical significance at the .05 level.

Table 3. Result of ANOVA on the treatment method at the pre-test phase in the experimental group and the control group

Source of Variation	df	SS	MS	F
Between group	1	195.03	195.03	3.66
Within group	90	4796.69	53.30	

$F_{.05}(1, 34) = 4.21$. $p>.05$

Table 3 shows that, at the pre-test phase, there was no significant difference of the mean occupational safety behavior score between the experimental groupand control groups.

Table 4. Result of ANOVA on the treatment method at the post-test phase in the experimental group and the control group

Source of variation	df	SS	MS	F
Between group	1	820.12	820.12	15.39*
Within group	90	4796.69	53.30	

$F_{.05}(1, 34) = 4.21$, *$p < .05$

Table 4 shows that, at the post-test phase, the mean occupational safety behavior score in the experimental group and the control group was different with a statistical significance at the .05 level.

Table 5. Result of ANOVA on the treatment method at the follow- up phase in the experimental group and the control group

Source of variation	df	SS	MS	F
Between group	1	1152.00	1152.00	18.16*
Within group	90	4796.69	53.30	

$F_{.05}(1, 34) = 4.21$; *$p < .05$

Table 5 shows that, at the follow- up phase, mean occupational safety behavior scores in the experimental group and the control group were different with a statistical significance at the .05 level.

Table 6. Result of ANOVA on the phase of experiment in the experimental group

Source of variation	df	SS	MS	F	p
Between subject	15	2587.00			
Interval	2	2692.67	1346.33	224.39*	.000
Error	30	180.00	6.00		
Total	47	5459.67			

*p < .05

Table 6 shows that the experimental group's mean occupational safety behavior scores at the pre-test phase, post-test phase and follow-up phase were different with a statistical significance at the .05 level. The experimental group's mean occupational safety behavior scores at the post-test phase and the follow-up phase were higher than at the pretest phase.

Table 7. Result of the ANOVA on the phase of experiment in the control group

Source of variation	df	SS	MS	F	p
Between subject	15	1919.98			
Interval	2	1.62	0.81	0.22	.80
Error	30	109.71	3.66		
Total	47	2031.31			

*p > .05

Table 7 shows that the control group's mean occupational safety behavior score in the pre-test phase , the post-test phase and the follow-up phase were not significantly different.

Table 8. Result of Newman-Keuls method of paired comparisons of the experimental group's occupational safety behavior scores at each phase of experiment

	$\overline{X}$	Pre-test 130.00	Post-test 145.50	Follow-up 146.25
Pre-test	130.00	-	15.50*	16.25*
Pre-test	145.50		-	.75
Follow-up	146.25			-
r			2	3
q.95(r,30)			2.89	3.49
$q.95(r,30)\sqrt{\frac{MSerror}{n}}$			1.77	2.14

*p < .05

Table 8 shows that the experimental group's mean occupational safety behavior score at the post-test phase and the follow-up phase were different from the pre-test phase scores with a statistical significance at the .05 level, while occupational safety behavior score at the post-test phase and the follow- up phase were not significantly different.

Conclusion

There were six main findings of this study:

1. There was an interaction between the treatment method and the phase of the experiment with a statistical significance at the .05 level.
2. At the post-test phase, power plant workers who were given behavior individual counseling had higher mean occupational safety behavior score than power plant workers working normally, with a statistical significance at the .05 level
3. At the follow-up phase, power plant workers who were given behavior individual counseling had mean higher occupational safety behavior score than power plant workers working normally, with a statistical significance at the .05 level.
4. At the post-test phase, power plant workers who were given behavior individual counseling had higher mean occupational safety behavior score than before being given treatment, with a statistical significance at the .05 level.
5. At the follow-up phase, power plant workers who were given behavior individual counseling had mean higher occupational safety behavior score than before being given treatment, with a statistical significance at the .05 level.
6. Power plant workers who were given behavior individual counseling had no differences in their mean occupational safety behavior scores at the posttest phase and the follow-up phase.

Discussion

1. The study found that there was an interaction between the treatment method and the phases of the experiment with a statistical significance at the .05 level. Each power plant worker was given the behavior individual counseling which consisted of ten sessions, each of 50 minutes over a period of ten consecutively weeks until they were aware of long-term consequences of unsafe behavior. Learning and awareness of uncertain long-term consequences of unsafe behavior encouraged power plant workers' commitment and the desire to change their unsafe behavior to safe behavior. The treatment program applied DVD modeling and a simulation story, together with a behavioral analysis (ABC model), which encouraged power plant workers' learning about and awareness of the influence of certain short-term consequences which support their unsafe behavior cycle. Using Skinner's learning theory based techniques, such as Contingency Management, Self Control, counseling skills supported the power plant workers' firmness and power to continuously develop occupational safety behavior. Although the treatment session was completed, power plant workers who participated in the treatment program continued to develop their occupational safety behavior by using Skinner learning theory based techniques. The research findings confirmed the claim of Skinner, who stated that human behavior is the consequence of human interaction with the environment. Human behavior would be changed by the influence of consequences happening in such an environment (Iamsupasit, 2007). Similarly, the research study entitled, "A comparison of the effects of self efficacy programme and KYT activity on safety at work operation behavior of operator in Daikin Industries (Thailand) Ltd", found that there was an interaction between the treatment method and the phases of the experiment with a statistical significance at the .05 level (Rorung, 2003).

2. The study's finding at the post-test phase and follow-up phase was that power plant workers who were given individual behavioral counseling had higher mean occupational safety behavior scores than power plant workers working normally, with a statistical significance at the .05 level.

Power plant workers given the behavior individual counseling using basic counseling skills and Skinner's learning theory based-technique learned about the uncertain negative long-term negative consequences which are caused by unsafe behavior and became aware of the enormous impact on themselves and their families. This awareness supported their intention to correct their unsafe behavior. Using Skinner's learning theory based technique, together with basic counseling skills, caused a change from unsafe behavior to safe behavior. Skinner's learning theory based technique used in this research consisted of behavioral analysis (ABC model), contingency contracting, contingency management and self control. Contingency contracting tied power plant workers with their will to continuously develop safe behavior by using formal contract techniques. Behavioral analysis (ABC model) supported power plant workers' learning and understanding of the influence of certain positive short-term consequences stimulating and maintaining power plant workers' unsafe behavior. Contingency management and self control using reinforcement techniques supported power plant workers' learning and practicing action plans to manage the influence of certain positive short-term consequences of unsafe behavior. The action plan was practiced in the working condition. The practice experience feedback was used for developing the original action plan. Furthermore, DVD modeling was used in the behavioral analysis (ABC model) to compare uncertain negative long-term consequences with certain positive short-term consequences. Power plant workers could learn and become aware of the stimulation and consequences of unsafe behavior and safe behavior from an observer's point of view. After completing the counseling program, awareness of the uncertain negative long-term consequences and understanding of unsafe behavior cycles kept the power plant workers continuing to develop their safe behavior. In the control group, power plant workers who did not undergo any treatment did not appreciate their unsafe behavior cycle and techniques to manage the consequence enforcement. The research findings confirmed the study entitled, "The effects of individual counseling based on behaviorism counseling theory on self controlled weight reduction behaviors of obese adolescents at Santirajivitayalai school in Bangkok metropolis", which found that obese adolescents who were given individual behavioral counseling had self controlled weight reduction behaviors greater than a control group (Prasertsan, 2005).

3. The study also found that, at the posttest phase and follow-up phase, power plant workers who were given individual behavioral counseling had higher mean occupational safety behavior scores than before being given the treatment. The treatment program increased the average power plant workers' occupational safety behavior. It consisted of ten consecutive weekly sessions:

Session 1-2 were used to create a strong relationship and trust or rapport between counselor and counselee.

Session 3 was used to assess occupational unsafe behavior level, educate about accident theory and increase awareness of accident impact.

In **Session 4**, the counselor used a contingency contracting technique to engage each counselee with their will.

Session 5 applied a behavioral analysis (ABC model) technique, together with DVD modeling, for counselees to learn about the influence of certain positive short-term consequences which stimulate and maintain their unsafe behavior.

Sessions 6-9 applied contingency management and self-control techniques to counselees to learn about the enforcement of unsafe behavior consequences. Also, they established the action plan for developing their safety behavior, and practice experience feedback was used for improving the original action plan.

Session 10 was the closing session to encourage counselees to continue their safety behavior development.

There have been studies using learning theory for changing unwanted behavior into wanted behavior. A study about using monitoring, recording and feedback techniques and conducting risk behavioral analysis process increased the occupational safety behavior among workers (Waters & Duncan, 2001). The study about the effect of behavioral counseling on smoking behavior of residents

on probation in Suphan Buri Probation Office found that probation residents who were given treatment could reduce their smoking behavior (Panyawuttiwong, 1994). Furthermore, behavioral counseling programs were successfully used for increasing the health behavior of post-menopausal women (Uerpongsathon, 2003) and reducing inappropriate speech of students (Boonsana, 2000).

Recommendation

The study's findings showed that individual behavior counseling using Skinner's learning theory based technique could develop the power plant workers' occupational safety behavior. Therefore, industrial sector authorities who are concerned with safety should consider applying the individual behavior counseling technique to develop occupational safety behavior to prevent accidents and injuries to their workers.

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