

The Effect of Group Participatory Learning Process on Knowledge, Attitude and Practice for Lead Contamination Prevention on Electrical Equipments and Electronic Devices Repairmen and Work Environment in the Area of Nakhonratchasima Province, Thailand

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Abstract: This research has a purpose to educate the effect of group participatory learning process on knowledge, attitude and practice for lead contamination prevention on electrical equipments and electronic devices repairmen and work environment in the area of Nakhonratchasima Province, Thailand. There were 39 volunteers as the example group in this research by the researcher producing a training plan and questionnaire relating to general information, knowledge, attitude and practice also finding a qualitative instrument in order to gather information before the training such as interview and soil powder collection at work places and sent them to laboratory to be investigated and analyzed. Furthermore, the training operation was done by the group of participatory learning process with operative occupational health with 3 steps as following; step1: Health Education, step 2: Job Safety Analysis and step 3: Evaluation of Participation. Four months operation were used in repeatedly gathering information after finished the process of informative analysis by Percentage (%), Mean (\bar{x}), Standard Deviation (SD) and Statistic Comparison which used t-test and F-test (One-way ANOVA). The result found that after had training programme, most of repairmen have more general and each aspects of knowledge, attitude and practice on lead contamination prevention than before taking the programme statistically significant rate of ($p < 0.05$) and importantly, the contaminated lead level in soil powder after the training programme was less than before taking the programme statistically significant rate of ($p < 0.05$). Effectively, the process of group participatory learning was applied in operative process of sanitary profession which making more knowledge, attitude and practice in repairmen's lead contamination prevention as well as the related government sectors should considerably put this form of training into workers' health improvement action relating to lead contamination safety and must be friendly to the environment.

Key words: Group participatory learning process, knowledge, attitude, practice, the prevention of lead contamination, repairmen, work environment, electrical equipments and electronic devices repair shops

INTRODUCTION

Chronic Lead Poisoning is one of the diseases that found in most of workers who work and touch with lead chemicals in long period of time, this lead would slowly enter into worker's body everyday and accumulating till transformed to be a chronic lead poisoning which has its characteristic of exhaustion, food boring, weight reduction, constipation, amnesia, weaken remembrance, short concentration, blur, intelligence reduction, anemia and found 80% of lead line from workers who have received lead chemicals for a long period of time

(Aorapan, 1992). People who work in the area of electric equipment and electronic device mending are risky from toxic substance especially from a high lead contamination because of lead is highly composed in electronic microchips and used in welding electronic devices, which the contaminated lead may enter into human body in 3 ways through inhalation, ingestion and skin absorption as working in the areas of lead fusing or welding which causes a lead effluvium is easily enters into human body through inhalation and people who work closely to this toxic substance may receive into their body by not cleaning their hands before consuming foods (Levy and

Wegman, 1995). Moreover, an electrical and electronic waste are classified as a hazardous waste that hardly decomposed and contained dangerous osmium such as Lead, Cadmium, Nickel, Arsenic and Beryllium Chemicals etc., especially, lead chemicals are highly found in the Printed Circuit Boards (PCB) averagely 50 g m^{-2} . Generally one television can be found lead chemicals 2 kg which this kind of hazardous waste would causes contamination impact on natural water resources, ground surface and atmosphere and also wildly spread into human, greenery and animals if there is no an appropriate management (Supattra, 2006).

Weerapol *et al.* (2010) educates problems condition from the electrical equipments and electronic devices repair profession by investigatory analyzing the level of blood lead contamination and found that the highest blood lead level was at $25.54 \mu\text{g dL}^{-1}$ and average at the level of $8.58 \mu\text{g dL}^{-1}$ ($\pm 6.37 \mu\text{g dL}^{-1}$). When comparing to other careers, there was a found that average blood lead level was higher than workers who work in vehicle fixing and spray work ($6.0 \mu\text{g dL}^{-1}$) (Nantarat and Kamenkhetkarn, 2001). All these repairmen have been using lead as welder and have no danger prevention form lead chemicals also have their behavior of throwing lead fragment into the local government garbage bins and their work floors. The test result of lead concentration in soil powder at the workers' seat areas found that the average value of lead was at 173.26 g kg^{-1} (± 98.31 , min-max 49.6-354), this shows that contaminated dust lead in workers' work environment are higher than the specified standard of US EPA. These people who work as a repairman are highly risky to danger from lead chemicals and would cause an impact for their family members especially children and environment as well. The important reason of this problem are about workers have not got knowledge, attitude, practice in preventing danger from lead chemicals and the appropriately managing illumination of hazardous waste (Weerapol *et al.*, 2010).

Then the researcher has constructed a training plan of group participatory learning process for the repairmen which divided into 7-15 people per group using principle of the step of experience presentation which efficiently reflected ideas and demonstrated an understanding, concept, experimentation or even application (Kolb, 1984) in occupational health activities and safety have met the highest achievement through the changes of knowledge, attitude and appropriate self preparation in preventing lead chemicals on repairmen and community environment to be at a safety level in order to maintain environmental quality of cleanness, safeness, lack of pollution and friendliness for human health permanently.

The research's purpose: To study the result from the group participatory learning process in the electrical equipments and electronic devices repairmen as following:

- For comparing the level of lead contamination before and after the training at the electrical equipments and electronic devices workshops
- For comparing knowledge, attitude and practice on lead chemicals prevention enters into workers' bodies and environment at work places before and after the training
- For comparing knowledge, attitude and practice on lead chemicals prevention enters into workers' bodies and environment at work places classifying by education level, work time duration per week and work experiences after the training

Hypothesis:

- Repairmen have knowledge, attitude and practice on lead contamination prevention after the training was higher than before the training
- Repairmen who differently have education level, work experience and the amount of work time duration per week, then after the training knowledge, attitude and practice on lead contamination prevention are not different

MATERIALS AND METHODS

This research was an action research, the form of one group pretest-posttest design.

Population: The used population in this research was the electrical equipments and electronic devices repairmen in local Sub-districts of Khong, Khamsakaesang, Nonthai and Nonsong Districts, Nakhonratchasima Province in the total amount of 39 repairmen from 24 repair shops.

Example group: The used example group in this research was as following; the electrical equipments and electronic devices repairmen in the mount of 39 repairmen from 24 repair shops by specifically and volunteeringly selecting to participate the research project.

The example group was laboratorially analyzed and collected around workshops' soil powder by specific selection at the usual sitting areas and longest daily, 1 m^2 each places by randomly selecting in the amount of 11 repair shops and examine the pre-post training in the total amount of 22 examples.

The used instruments: In this research were divided into 3 types as following: the instruments in training process

were training plan and expert handbook by managing a group participatory learning knowledge relating to safety and occupational health activities as following; step 1: Health Education, step 2: Job Safety Analysis and step 3: Evaluation of Participation. Quality has been found by 5 experts composed with the Average Score Index = 4.5 points and IOC Index = 0.80 and try out with the repairmen training not with the example group and finally had the Effectiveness Index = 0.70.

The instrument that for information gathering in this research was a 4 parts questionnaire composed with; Part 1: Informative population characteristic such as age, education level, work experience and quantity, Part 2: Knowledge about danger of lead, Part 3: Attitude for danger of lead and Part 4: Practice on lead danger prevention. The instrumental quality has been testified by 5 experts and had IOC Index = 0.80, questionnaire part 2: according to knowledge had Reliability Index KR20 = 0.91, questionnaire part 3 in part of attitude and part 4 in part of practice had Reliability Index orderly by the Cronbach Alpha's Coefficient = 0.90 and 0.91.

Atomic Absorption Spectrophotometry (brand: Perkin-Elmer, model: Analyze 300) using standard method of Perkin Elmer to experimentally analyzes lead chemical in the example dust lead at the laboratory of Department of Environmental Engineering, Faculty of Engineering, Khonkaen University.

Research operation and information gathering step of preparation:

To set up conference for hospitals' public health officers, district public health officers and sub-district public health officers in the amount of 16 people and reconsidered the role of the group participatory learning process group monitoring.

Step of training operation: The research operation and information gathering were divided into 4 steps as following:

Step 1:

- To gather information before the training takes part by interviewing population characteristic information relating to knowledge, attitude and self preparation on lead danger prevention from repairmen and randomly collect the example of soil powder at the plots where workers operate their work after finished their work in the amount of 11 examples

Step 2:

- To operate training in the research areas. To set up a participatory group activity for the first time, operated training activity in the form of participatory group

process in the step of Health Education was divided into 7-15 people per group and the training consumed 1 day in this operation. According to the specified 4 parts training plan; Part 1: In part of receiving danger from lead chemicals; Part 2: In part of personal danger protection equipments; Part 3: In part of personal hygiene and work principles; Part 4: In part of hazardous waste management by the researcher was a lecturer and the public health officers were a participatory group

- To set up a participatory group activity for the 2nd time, the step of Job Safety Analysis was producing each group's solution policy and improvement plan and demonstrated the activity result before finalizing the groups
- The example groups consumed 2 months in operating the specified plans of problem solution and improvement
- To set up a participatory group activity for the 3rd time, in the step of Evaluation of Participation, the research, public health officers and example group have evaluated on site operation together

Step of research result evaluation: To gathering informative interview which used the part 2-4 of questionnaire randomly collected soil powder on the ground after work in the amount of 11 examples and directly sent for lead examination.

Data analysis: They were analyzed for collecting data by Percent (%) mean (\bar{x}), Standard Deviation (SD) and compares the knowledge attitude and practice levels of repairmen with different education levels, time experiment and time worked load by t-test (Dependent t-test) and F-test (one-way MANOVA).

RESULTS AND DISCUSSION

General characteristic of the studied population: The electrical equipments and electronic devices repairmen in local sub-districts of Khamsakaesang, Nonthai, Nonsoong and Khong Districts, Nakhonratchasima Province in orderly the amount of 14, 11, 8 and 6 people in total of 39 repairmen from 24 repair shops, 24 repairmen are shop owner and the rest of 15 repairmen are employees. There was a found that most them are males and still in a work-force age between 30-45 years old (69.24%) secondly are below 30 years old and >45 years old (15.38%), married (66.70%) and single (25%) in case of education level most of them have not finished their diploma (64.10%) and secondly have their qualification more than diploma (35.90%) have work experience

Table 1: Comparison on workers' knowledge, attitude and practice in preventing lead contamination before and after the training

Test statistics	Contaminative	Before the training (n = 39)		After the training (n = 39)		T	p-value
	Prevention	X	SD	X	SD		
Knowledge	1. Chemical lead danger	3.61 (51.5)	1.90	6.41 (91.5)	0.81	-8.833	0.000*
	2. Danger prevention	3.54 (59.0)	1.60	5.25 (87.5)	0.85	-7.136	0.000*
	3. Collection and elimination	3.58 (51.1)	1.84	6.15 (87.8)	0.84	-8.605	0.000*
	General	10.35 (51.7)	3.86	17.82 (89.1)	1.85	-12.625	0.000*
Attitude	1. Chemical lead danger	2.72	1.12	4.28	0.37	-8.416	0.000*
	2. Danger prevention	2.75	1.02	4.41	0.33	-10.162	0.000*
	3. Collection and elimination	2.99	0.96	4.46	0.35	-9.089	0.000*
	General	2.81	1.00	4.38	0.29	-9.593	0.000*
Practice	1. Chemical lead danger	2.37	0.85	4.65	0.27	-16.363	0.000*
	2. Danger prevention	2.27	1.15	4.50	0.42	-11.455	0.000*
	3. Collection and elimination	2.99	0.88	4.59	0.28	-12.060	0.000*
	General	2.53	0.86	4.59	0.27	-15.163	0.000**

Have statistical significance level of 0.05; 1 means highly disagree and never operated; 2 means disagree and rarely operate; 3 means unsure and sometimes operate; 4 means agree and often operate; 5 means highly agree and operate every times

>10 years (51.28%) and secondly are between 1-5 years of work experience and lastly they work >40 h per week (56.40%) and secondly work <40 h per week (43.60%). Additionally, most of them have never been received work safety training (82.10%) even though this kind of work is a business family has no government social security, sanitary activity operation which is risky of sickness from work and causing a harmful pollution for communities (Ganjana, 2004). The repairmen similarly have their work characteristic and problem condition have the various work experiences are ready in age of learning and actively interested to be part of this research project. Then if there was an application together between the ideas of learning experience (Kolb, 1984) and the group participatory learning process, it would be greatly appropriate for adults' learning.

Comparing knowledge, attitude and practice of the electrical equipments and electronic devices repairmen with lead contamination at repair shops before and after the training and found as following: After received the training, in general the workers have knowledge and understanding of lead chemicals' danger (91.50%) which more than before the training, 87.50% have more knowledge and understanding in the aspect of preventing from lead danger more than before the training. The general consideration after the training (89.10%) have knowledge and understanding more than before the training which the workers in general have all 3 training aspects than before which statistically have significance level of 0.05 (Table 1).

After received the training, in general the workers have attitude of lead danger at the agreement level ($\bar{x} = 4.28$) which is higher than before the training in the aspect of lead danger prevention was at the agreement level ($\bar{x} = 4.41$) which is higher than before the training and in

case of hazardous waste collection and elimination was higher than before the training ($\bar{x} = 4.46$). When generally considering after the training attitude was at the agreement level ($\bar{x} = 4.38$) which higher than before taking the training programme as well as after the training the workers statistically have their attitude on 3 aspects training more than before at the significance level of 0.05 (Table 1). After received the training the workers in general have practice in the aspect of lead danger prevention in the operative level every times ($\bar{x} = 4.65$) which higher than before the training, in case of lead collection was often at the operative level ($\bar{x} = 4.50$) which higher than before the training and in the aspect of hazardous waste illumination was higher than before taking the training at the operative level every times ($\bar{x} = 4.59$). Generally when considering after trained, their practice were higher than before the training at the operative level every times ($\bar{x} = 4.59$) and workers have statistically practice after trained in all 3 training aspects more than before taking the training at the significance level of 0.05 (Table 1).

The research result shows that after the training participants have a higher of knowledge, attitude and practice than before taking the training in each aspects and general which resulted from the activity of group participatory learning contains of 2 learning principles as: Experiential Learning and Group Process. To apply these principles to be a knowledge foundation helps to promote individuals achieving their goals or a needed behavior because group interaction causes opportunity for individuals changing their knowledge, experiences as well as being a motivation among them (Ganjana, 2006). This conduct towards problem solution through the action of group participatory learning process and being a experiential production for group members to produce their learning, idea, attitude and practice (Malee, 1987).

Table 2: Comparison on workers' knowledge, attitude and practice in preventing lead contamination after the training for who have a different education level (one-way MANOVA)

Tested statistics	Value	Hypothesis	Error df	F	p-value
Pilla's trace	0.109	3	35	1.432	0.250
Wilks' lamda	0.891	3	35	1.432	0.250
Hotelling's trace	0.123	3	35	1.432	0.250
Roy's largest root	0.123	3	35	1.432	0.250*

Statistical significance level of 0.05

Table 3: Comparison on workers' knowledge, attitude and practice in preventing lead contamination after the training for who have a different work experiences (one-way MANOVA)

Tested statistics	Value	Hypothesis	Error df	F	p-value
Pilla's trace	0.146	3	35	1.987	0.134
Wilks' lamda	0.854	3	35	1.987	0.134
Hotelling's trace	0.170	3	35	1.987	0.134
Roy's largest root	0.170	3	35	1.987	0.134

Table 4: Comparison on workers' knowledge, attitude and practice in preventing lead contamination after the training for who have a different work load per week (one-way MANOVA)

Tested statistics	Value	Hypothesis	Error df	F	p-value
Pilla's trace	0.078	3	35	0.983	0.412
Wilks' lamda	0.922	3	35	0.983	0.412
Hotelling's trace	0.084	3	35	0.983	0.412
Roy's largest root	0.084	3	35	0.983	0.412

Comparing workers' knowledge, attitude and self practice on chemical lead contamination after training who differently have education level, work experience and work time load per week has found as following: After the training workers who have their different education levels have knowledge, attitude and practice on lead contamination indifferently ($p > 0.05$) (Table 2). After the training workers who have their different work experiences have knowledge, attitude and practice on lead contamination indifferently ($p > 0.05$) (Table 3).

After the training workers who have their different work time load have knowledge, attitude and practice on lead contamination indifferently ($p > 0.05$) (Table 4). The research result shows that the group participatory learning process in the step of occupational health operation is appropriately to join with adult learning even though there still be personal factors in educational, experiential aspects and also workers' work quantity differently but after training the desirable characteristic that would be promotable are not different.

This is because the experiential learning is a form of reproductively true workers' experiences setting up as question and train participants to be aware on the happened problem solutions in their real lives. Furthermore, this is helpful for the learners to practice their thinking skill and able to decide and choose right operative way by using themselves' true experiences and combine with group members' exchanging experiences which symbolized to a social skill practice. When learners' opinions, experiences are acceptable and useful for group consideration, then owners of experiences would be proud of and appreciative in themselves also (Department of Mental Health, Ministry of Public Health, 2004).

Table 5: Comparison on the average value of lead contamination in soil powder before and after the training (t-test)

Example (N = 22)	Quantity of the found chemical lead in soil powder				
	Means (g kg ⁻¹)	SD (g kg ⁻¹)	Min-Max (g kg ⁻¹)	t	p-value
Before the training	173.26	98.31	49.6-354	5.206	0.001*
After the training	13.82	25.48	0.16-86.71		

Statistical significance level of 0.05

Comparing chemical lead contamination at work place before and after the training: The researcher randomly collected soil powder around work seat areas for analyzing and found that after the training chemical lead contamination in soil powder has an average value of 13.82 g kg⁻¹ (± 6.37) which less than before the training statistically at significance rate of $p < 0.05$ (Table 5).

This demonstrates that repairmen are aware and behaved themselves in collecting lead fragments in the provided container after finished welding, however the average value of lead chemicals in soil powder still have a higher value than the specifically lawful standard (750 mg kg⁻¹) and have an unsafe work environment. There has been after constantly from the local public health officers which helps in reducing chemical lead contamination in soil powder to be at a safety level which corresponding to Ganjana (2004) studied that people who work in their accommodations agreed with the idea of hazardous prevention and elimination should be a responsibility for shop's owner by accrediting the local officers to be an important inspection sector and let the community members to be part of it which causing operation as an achievement.

CONCLUSION

The result of group participatory learning process on occupational health operation in the step of Health Education, Job Safety Analysis and Evaluation of Participation is efficiently to make the levels of workers knowledge, attitude and self preparatory in preventing chemical lead contamination more than before taking the training and found that after the training has less chemical lead contamination in soil powder than before the training statistically at the significance level of $p < 0.05$. This shows that workers have produced knowledge, understanding, awareness and behaved themselves in preventing chemical lead contamination to themselves and environments which is desirable characteristic according to the specified target goal.

RECOMMENDATIONS

Most of the workers who have their career closely to lead chemicals are very risky to its' danger especially the job that out of social security system and also still have no operation of sanitary profession which related government sectors should actively operate and bring the group participatory learning process in the occupation health operation step to be used in workers' health promoting which would cause an outstandingly environmental quality and safety.

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