THE DEVELOPMENT OF INTEGRATED ENVIRONMENTAL EDUCATION ACTIVITIES FOR SOLID WASTE MANAGEMENT IN LIBONG ISLAND, TRANG PROVINCE, THAILAND

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Abstract: The purpose of this research, firstly, aimed to develop integrated environmental education activities for solid waste management in Libong Island, Thailand. The activities were built on an integrative research approach which consisted of four elements: inquiry process, participatory process, Participatory Rural Appraisal (PRA) and Appreciation-Influence-Control (AIC). Secondly, the research aimed to compare achievement of knowledge, attitude, awareness, skill and participation in solid waste management between an experimental group (32 participants) and the control group (32 participants). Participants were selected using voluntary non-random and purposive methods from village representatives, students, teachers, religious leaders, government and local community authorities. The research used the Pretest - Posttest Control Group Design. The research tools were an instructional plan of activities and achievement tests. Data were described in percentages, with normally distributed data described by mean and standard deviation. A t-test was also used to test the research hypothesis. The research results found that the integrated environmental education activities consisted of four learning units and 13 activities. In addition, participants in the experimental group performed significantly better in achievement tests on knowledge, attitude, awareness, skill and participation at 0.05 level. This indicated that the activities succeeded in imparting knowledge, increasing skill and participation as well as creating a positive attitude and raising awareness in solid waste management. The finding can be applied to developing best practices in solid waste management for other municipalities under similar circumstances.

Keywords: Solid Waste Management, Environmental Education, Environmental Activities.

Introduction

Solid wastes production has become one of the world's leading environmental problems primarily because of an increase in population and a rise in human activities

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that ensue. Coupled with a growth of industries to keep pace with rising demands, natural resources have been exploited while many solid wastes have been produced.

The Pollution Control Department, Ministry of Natural Resources and Environment, Thailand has reported in 2014 that 26.17 million tons of wastes were produced annually in all 77 provinces, but 14.80 tons, or 56.55% of the total solid wastes remained untreated (Pollution Control Department, 2015). Insufficient manpower for waste collection, a lack of knowledge in waste management on the part of stakeholders, and an unavailability of technology for waste reduction have accounted for the remaining wastes which have threatened the environment and human health. Solid wastes problem has become a national agenda. Realising the severity of the issue, the National Council for Peace and Order (NCPO) and the present government have drawn an ad hoc policy to contain the damage (Nitcha, 2015).

Environmental Education serves as a learning process that gives them the needed knowledge and make them aware of the environment and its associated challenges. The process also develops the skills and expertise necessary in tackling the issue while fostering attitudes, motivations, and commitments to make informed decisions and take responsible action (UNESCO in Co-operation with UNEP, 1977). Moreover, the original environmental education is intertwined with the international education for sustainable development concept of today. Environmental education is an important instrument for sustainable development.

From past literature that the integrative research approach on environmental education for solid wastes management in the island circumstance had not yet been done, nor environmental education activities applied. This research, then, presents the development of the integrated environmental education activities for solid waste management in Libong Island, Trang Province, and the creation of instruments used to evaluate the results of the activities. This article also aims to compare an achievement between the experimental and the control groups on knowledge, attitudes, awareness skills, and participation on waste management both before and after participating in the activities developed for the purpose.

Objectives

Two following objectives of this research article were:

1. To develop integrated environmental education activities for solid waste management in Libong Island, Thailand.
2. To compare achievement of knowledge, attitude, awareness, skill and participation in solid waste management between an experimental group and the control group.

Literature Review

Solid Waste Management in Libong Island

Situated in the southwest of Thailand in Trang Province, Libong Island, with 743 households and a population of 2,370, covers an area of 66.52 square kilometers (Community Development Information Center, 2015). Most of the inhabitants are

Muslims and work on rubber plantations. Biggest island in Trang Province, Libong is rich with forests as well as coastal and marine resources. It is a place where seagrass, a food source for the near-extinct dugongs, grows abundantly. Several dugongs, which are reserved wildlife, can be found there. In 2012, 22 dugongs were reportedly found in the non-fishing zone around Libong Island) (Wildlife Conservation Office, 2012).

However, Libong is now facing solid wastes pollution. The island itself is small and so is limited in space. Waste management is ineffective for there are no local authorities to oversee the management directly. Although the Sub-District Administrative Organisation has a space for unsanitary landfill, the village has no garbage trucks nor garbage collectors to transport the wastes to the dump site. The villagers either take the trash to the landfill themselves or, most likely, dump it anywhere: around the houses, in public areas, along the beaches, in the ocean or by the entrance to the landfill as the area usually gets muddy during rainy season. Wastes are also burnt in open spaces as well as buried underground. Left uncollected, many wastes can be found in the communities and near the beaches. The quantity of solid wastes calculated in relation to population was 1.08 tons/per day in 2011 (Phisut Technology Co., Ltd., 2011). Kanokrat, Porntip, Suwit and Anan (2009) interviewed the Libong locals (n = 200) and found that the quantity of solid waste less than 1 kilogram/per household/per day. Rajamangala University of Technology Srivijaya, Trang Campus (2011) studying marine debris in Libong Island reported that solid wastes remain rate in community was the area from the residences to the beach between 0.003 - 0.060 piece/per square meter/per day. These wastes adversely affect the island and the ocean environment, especially the marine animals around Libong Island which mistake the wastes such as plastic bag for their food source.

The Libong locals want local organisations to address the problem. For example, they should provide training for the people so that they will have the knowledge in waste management. The training will also increase their skills, raise their awareness and participation, as well as foster a positive attitude. Environment education is, therefore, an answer to the problem they are facing.

Environmental Education Tools for Solid Waste Management

The previous researches on environmental education had been used as a tool to foster the afore-mentioned learning process.

Some of the examples are: the educational set (textbook for students and manual for teachers); the recycling roadshow' program (meetings and talks, leaflets and newsletters, information packs, posters, media campaigns, school and kindergarten programs); learning activities (training of waste, field trip of waste management and waste reduction management project, Appreciation-Influence-Control (AIC) activity for waste reduction project, a summary of the learning activities and the cleanliness protection club; solid waste management program (short course and hands-on activities) (Kanokrat and Umaporn, 2015); Participatory Action Research (Pangamol and Saowalak, 2004); waste minimisation exercise (Fahy and Davies, 2007); Training course (Document, Personal media (lecturer) and Group activity) (Surachai, Chadrudee, Suphawadee and Kumphol, 2008); School-based solid waste

management (Enrico, 2010); Taking Home Action on Waste (THAW) project (Maddox, Doran, Williams and Kus, 2011), and etc.

Environmental Education Tools for Solid Waste Management in Island
For Island, similar tool had been utilised such as activate awareness activity (provide knowledge about waste management); Training program about waste management (Kanokrat and Umaporn, 2015); Training program and the field trip about waste management (Designated Areas for Sustainable Tourism, 2010); environmental education activities (an orientation, public relation, knowledge sharing, training) (Thaihealth and Health System Management Institute, 2013); trained and practiced activities about reduce, separation and utilisation of waste (Regional Environment office 14 (Suratthani), 2009), and etc.

Conceptual Framework
Conceptual framework applied from the Educational system approach including to input, process, output and monitoring and evaluation (Boonchom, 2003). Input consisted of integrated environmental education activities for solid waste management developed from this study, as well as the stakeholders involved from the Public (students, villagers, teachers, and religious leaders), local community authorities, government authorities and researcher. Four main integrated methods of participatory process, PRA, inquiry process, and AIC operated the environmental education activities. Then output from this study on learning achievement of knowledge, attitude, awareness, skill and participation were finally monitored and evaluated the results as shown in Figure 1.

(See Figure 1 on the next page)

Method

1. Research Design
The research used the Pretest - Posttest Control Group Design (Usavadee and Kanchana, 2013). Participants in the treatment and control groups were asked permission for participation. Pretest was conducted on both groups. The experimental group worked on with the environmental education activities, but not the control group. Pretest was given to the two groups in the end.

2. Scope of the Research

1) Area Scope
The studied area was in Libong Island, an island in Trang Province off the Andaman Ocean, and in the southwest of Thailand. It was selected using the purposive sampling which selects samples to suit the objective and the context of research (Palys, 2008). Participants were invited and asked for permission and the willingness for participation before attend to this research.

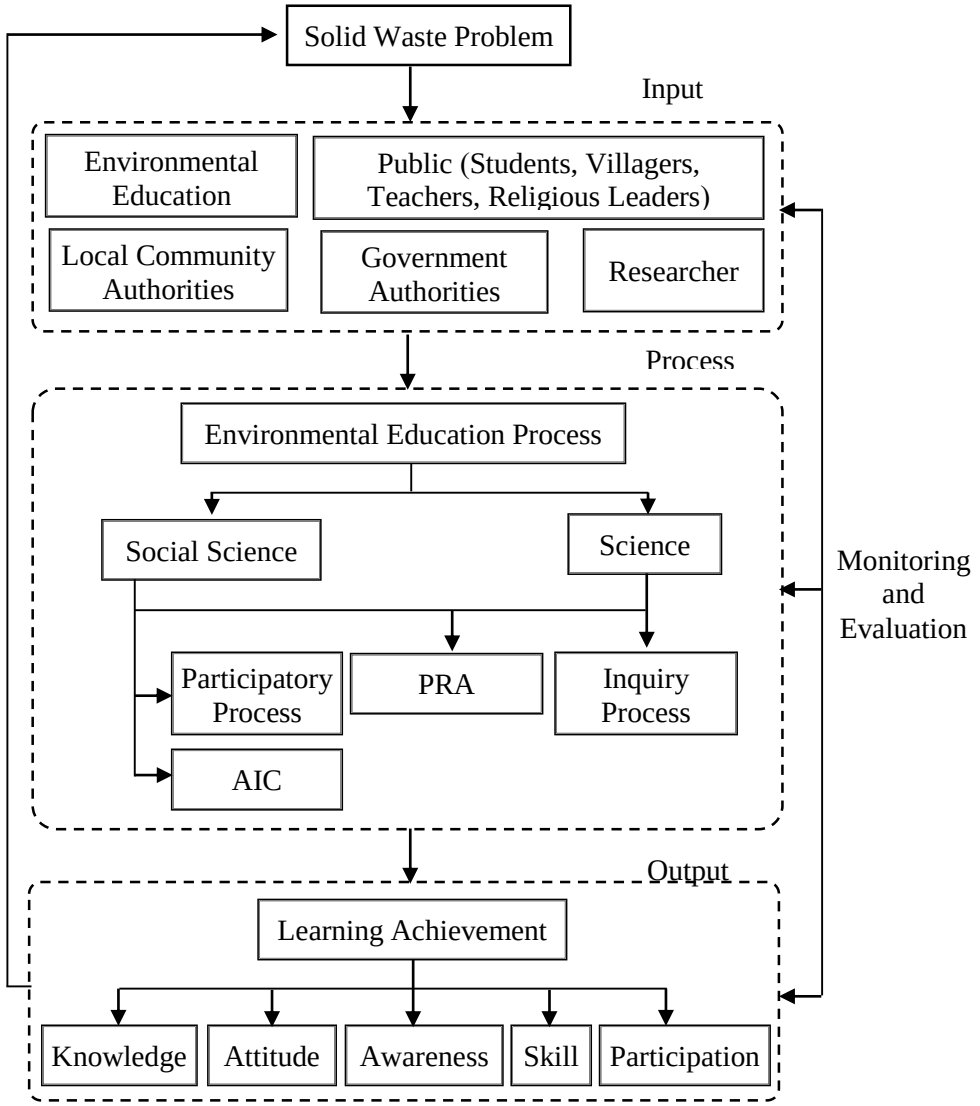

Figure 1: Conceptual Framework of This Study

2) Population Scope

This research categorized the Libong population into three groups: public sector, private sector, and citizen sector. The public sector included 32 people acting as:

- Chief Executive of the Libong island Sub-district Administrative Organization;
- Member of the Libong island Sub-district Administrative Organization Council;
- Chief Administrator of the Libong island Sub-district Administrative Organization;
- Chief and staffs of Office of Libong island Sub-district Administrative Organization;
- Head of Sub-district;
- Head of Villagers; and

▪ Assistant of Head Villagers

The private sector consisted of 299 people working for the Community Organization Network, the Occupations Group, the Women Group, the Homestay Group, and the Savings Group of Libong Island. The rest of the inhabitants fell into the citizen group, of which four were religious leaders, 472 students, and 30 teachers at Batupootek School, Libong Island. The samples were selected from these three groups using voluntary non-random and purposive methods and divided equally into two groups: the experimental group and the control group. Each had 32 participants.

3) Content Scope

The content was on solid waste management.

3. Research Tools and Assessments of Their Effectiveness

The instruction plans which had been developed for the purpose was assessed by four examinators for content validity on overall effectiveness. The experts assessed the 'Activity – Objective Congruence' of which the scales were set at 0 - 3, and the Index of Consistency (IOC) of which the scale determination of +1 signifying: agree; 0: not agree, and -1: not agree. Their suggestions were applied to improve the instructional plan.

Pretest-Posttest were used to measure knowledge, attitudes, awareness, skills, and participation. Details are as follows:

(1) Multiple choices tests to evaluate knowledge were assessed by the examinators for content validity using IOC. The results were used to find the Difficulty Index (p) and the Discrimination Index (r). The tests were analyzed for reliability using Kuder - Richardson 20 (Orawan, 2009).

(2) Tests of attitude, awareness and participation in waste management were developed based on the Likert's Scales. The scales of attitudes and awareness tests were set at 1 – 5; while those of the participation test were set at 1 - 3. Then, the Content Validity was assessed by the examinators using IOC (Karnda, 2003). The results of the tests were analyzed for Discrimination Index (r) using. Item total correlation (Waro, 2008), and for Reliability using Cronbach's Alpha.

(3) Tests of skills on waste management involved essay-writing and short responses. IOC, Difficulty Index (p), the Discrimination Index (r) and Reliability with Cronbach's Alpha were analyzed (Pichit, 2007).

4. Statistics Used in Data Analysis

1) Preliminary statistics

Percentages were used with the results of the evaluation on overall effectiveness of the learning activities. Mean and standard deviation were used to identify t-test for hypothesis testing.

2) Hypothesis statistics

The t-test independent statistics was used to compare an achievement between the experimental group and the control group on knowledge, attitudes, awareness, skills and participation.

Results

The activities constructed for this research study were based on the integrative research approach and integrated methodologies to create new knowledge and combine science with social science. Inquiry process and participation were incorporated in the activities. Participation started by steps with 1) Preparation; 2) identifying problems and causes; 3) deciding on guidelines, planning development and solutions; and 4) practicing and evaluating.

Learning Unit one was intended to prepare the experimental group for the coming activities.

Activity one. The researchers set up the meeting, explaining the background, objectives, and benefits of the environmental activities. This activity provided information on solid wastes problem, raised awareness, and created acceptance for the activities. Included were factors that influenced the attitudes and the behaviors of the people concerning waste management.

Activity two. Participants drew diagram showing social relationship among experimental group members which indicated how wastes could be managed. The activity motivated social participation in solid waste management.

Activity three. Locally-designed T-shirts were used as media for campaign promotion on waste management. The screen print was designed by the experimental group who wore the T-shirt all through the program. This activity served as continuing public relations for the environmental education program. As a result, participation was satisfactory in all activities.

Identifying the problem and its causes (Learning Unit 2, Activity 4-9) involved the use of Participatory Rural Appraisal or PRA method. It included identifying sources of solid wastes, talking about seasonal calendars, and history of waste management, and interviewing participants how they disposed wastes. Participants also explored the quantities and the types of solid wastes, doing Venn diagram, and taking actions.

Deciding on guidelines, planning development and solutions involved the use of the Appreciation-Influence-Control or AIC method (Learning Unit 3, Activity10-12).

Practicing and evaluating were the implementation and evaluation of activities on solid waste management (Learning Unit 4, Activity 13).

In sum, the four Learning Units and 13 activities succeeded serving the intended purposes of this research. (see Table 1)

Table 1: The Environmental Education Activities for Solid Waste Management

Learning Unit	Activity	Time	
		Design	Actual Activity
1. Preparation	1. First meeting	60 mins	45 mins
	2. Mapping out relationship among community members	60 mins	50 mins
	3. Promoting environmental education activities through locally – designed T-shirts	180 mins	90 mins

Table 1: The Environmental Education Activities for Solid Waste Management

Learning Unit	Activity	Time	
		Design	Actual Activity
2. Identifying the problem and its causes: PRA	4. Identifying sources of solid wastes	120 mins	90 mins
	5. Identifying seasonal activities and phenomena which bring about solid wastes	120 mins	60 mins
	6. History of solid waste management	120 mins	100 mins
	7. Villagers' behavior in solid waste management	180 mins	5 days (240 mins/day)
	8. Types and quantities of solid waste	1 week (60 mins/day)	1 week (15-30 mins/day)
	9. Stakeholders in solid waste management	120 mins	105 mins
3. Deciding on guidelines, planning development and solutions: AIC	10. Appreciation	120 mins	100 mins
	11. Influence	120 mins	90 mins
	12. Control	120 mins	90 mins
4. Practicing and evaluating	13. Practicing and evaluating	1 month	2 months, and 7 days

1) Assessments From Four Examinators:

After the environmental education activities on solid waste management were designed, the overall effectiveness of learning activities plan was assessed by four examinators. It was found that the activities were at excellent level at 91.79 of average scores. (see Table 2)

Table 2: The Overall Effectiveness of Learning Activities Plan

Expert	Results of evaluation **(%)**	Opinion level
1	100	Excellent
2	100	Excellent
3	83.33	Excellent
4	83.81	Excellent
Average	91.79	Excellent

Remarks: Poor = score 0.00 – 25.00, Fair = score 25.01 – 50.00, Good = score 50.01 – 75.00, and Excellent = score 75.01 – 100.00

Table 3 shows the results of the Activity – Objective Congruence on knowledge, awareness, attitudes, skills, and participation. The IOC index were between 0.50 – 1.00 which meant that they were acceptable as the score was higher than 0.50.

Table 3: The IOC Index in The Instructional Plan of Environmental Education Activities

Topic of The Activity – Objective Congruence	IOC (Standard > 0.5)
Knowledge	0.75 – 1.00
Awareness	0.50 – 1.00
Attitudes	0.50 – 1.00
Skills	0.75 – 1.00
Participation	0.75 – 1.00

2) Qualities of Evaluation Forms

(1) Tests: The quality of knowledge test from the four examinators found that the IOC index was higher than 0.5 meaning that the 20 questions of the test were able to measure accordingly to the objectives of instructional plan. After that, the 20 questions of test were assessed for p and r values. They should pass the p value of 0.2 – 0.8 and the r value of 0.2 – 1.00. The results found that 13 questions were passed the p and r assessment. Reliability analysis was at 0.722 which was more than 0.7. Thus, this tests' Reliability was appropriate for use with the samples. (see Table 4)

(2) The quality of awareness test from the examinators showed that the total 7 questions passed the IOC evaluation. After that, the r was tested using Item total correlation. If the result is $r < 0.296$ that means "pass". The result from this r passed the 6 questions. Reliability analysis was at 0.704. Thus, this awareness test was appropriate for use. (see Table 4)

(3) The quality of attitude test from the examinators showed that the total 13 questions passed the IOC evaluation. Then, the r was tested, and it was found that nine questions were suitable. Reliability test was at 0.755. Therefore, this attitude test was appropriate for use. (see Table 4)

(4) The quality of skill test showed that the total eight questions passed the IOC and p and r index evaluations. Reliability test was at 0.937. Thus, this skill test was appropriate for use. (see Table 4)

(5) The quality of participation test showed that the total 15 questions passed the IOC and r evaluations. Reliability test was at 0.964. So, the participation test was appropriate for use. (see Table 4)

Table 4: Qualities of Evaluation Forms

Test	Qualities of Evaluation			
	IOC	p	r	Reliability
Knowledge	20/20*	19/20*	13/20*	0.722
Awareness	7/7*	N.A.	6/7*	0.755
Attitude	13/13*	N.A.	9/13*	0.704
Skill	8/8*	8/8*	8/8*	0.937
Participation	15/15*	N.A.	15/15*	0.964

Note: * = questions passed/total questions

With assessments done, the instructional plan of activities was used in the experimental field. The timeline for all activities was set at two months. But the activities took six months to complete because of either bad weather, windstorms,

long holidays, or participants engaged in social functions such as wedding ceremonies, funerals, and school activities. (see Table 1)

Table 1 shows that most activities took less time than the designated time mainly because of the participants' undevided attention on the given tasks. However, Learning activity 7 and 13 took longer time. For the Learning 7, the participants had to do an interview in four faraway villages. As for Learning activity 13, bad weather made the researchers unable to travel to travel to Libong Island to monitor and evaluate the activities.

The comparative study of an achievement between the experimental group and the control group on knowledge, attitudes, awareness, skills and participation towards waste management found that the both groups were significantly different. The experimental group's achievement on all areas measured was significantly higher than that of the control group at 0.05 level. (see Table 5).

Table 5: The Comparative Study of An Achievement Between the Experimental Group and The Control Group on Knowledge, Attitudes, Awareness, Skills and Participation Towards Waste Management (N = 32)

Topic of evaluation	$\bar{x}$		S.D.		t	Sig.
	C.G.	E.G.	C.G.	E.G.		
Knowledge	-0.188	3.094	2.023	2.855	-5.304	0.000
Awareness	0.906	3.938	3.206	4.931	-2.915	0.005
Attitudes	0.031	2.000	2.753	3.101	-2.686	0.009
Skills	-0.094	2.438	0.756	2.848	-4.860	0.000
Participation	-0.094	7.875	3.186	8.296	-5.072	0.000

Note: C.G. = Control group (n = 32); E.G. = Experiment group (n = 32)

At the completion of the activities, it was found that each of the criteria was met. The experimental group developed knowledge, attitudes, awareness, skills and participation on solid waste management.

Knowledge: Participants knew the sources of solid wastes, the activities which created wastes, and how relationship in the community could play a part in wastes reduction. They recognised the types and the quantities of wastes produced by households and communities or brought to the shores by seasonal calendars. They knew the behaviors of the villagers in handling wastes and the history of wastes management. They recognised the stakeholders, their roles, and responsibilities in wastes reduction as well as knowing how to develop guidelines and plans for wastes management.

Awareness and Attitude: Participants were aware of solid wastes management and developed a positive attitude towards it.

Skills: Participants were able to draw a community map and produce the SWOT (Strength, Weakness, Opportunity, Threat) analysis on solid waste management of the past and applied it to that of the present and the future. They could compare the villagers' behaviors on wastes management in each village for each source of wastes, as well as compare the types and the quantities of wastes produced from each source. They could analyse how the behaviors could bring about wastes problem. They were able to collect, sample, and separate wastes together with creating a practical plan for

the present and the future. Lastly, they could perform and evaluate solid wastes management activities.

Participation: The experimental group participated in drawing a vision of future wastes management, devised guidelines and plans as well as performing and evaluating the activities.

Discussion

The integrated environmental education activities for solid waste management at Libong Island, Trang Province consisted of four learning units with 13 activities. The experimental group's achievement on knowledge, attitudes, awareness, skills and participation was significantly higher than that of the control group at 0.05 level. The activities were designed in accordance to the definition of environmental education made by the UNESCO in Co-operation with UNEP in Tbilisi (USSR) in 1977.

> *"... a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has knowledge, attitudes, motivations, commitments and skills to work individually and collectively towards solutions of current problems and the prevention of new one"* (Hassan, Osman and Pudin, 2009, p.2).

Moreover, the developed activities incorporated the inquiry process, of which the steps were conducive to environmental education because it enabled the learners to create new knowledge by themselves. A process which facilitated the thinking and the practice through scientific process, it motivated learners to seek knowledge and analyse data. Learners developed knowledge and skills on their own, using scientific process (Reutai, 2008). The developed activities also integrated participation process which consisted of identifying problems and causes of problems, deciding on guidelines, planning development and solutions, practicing and evaluating activities. Participation was recommended as most appropriate in managing municipalities' wastes) (Chakrabarti, Majumder and Chakrabarti, 2009).

In addition, Participatory Rural Appraisal or PRA method was used in the process of problems/causes identification as it was able to stimulate interests and motivate youngsters, making them able to learn with adults in a community (Doyle and Krasny, 2003). PRA was also a process in which the locals learned about their community, with researchers acting as facilitators from the start to finish. Learners were able to analyse, make decision, and find a solution (Khanchit, 2010).

Deciding on guidelines and planning development and solutions steps involved the Appreciation-Influence-Control or AIC method. It encouraged awareness and cognition which led to participation in finding a solution (Noppawan, 2003).

However, there were the limitations on time management and participation in which future researchers should take into consideration. Selecting target group of participants by duties might be a better option for the future research.

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