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Community Learning Process: A Model of Solid Waste Reduction and Separation

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Abstract

The main purpose of this research was to study and develop an appropriate model of waste reduction and separation in the community under the community learning process. This is a research and development (R &D) study with mixed methodology consisting of four steps. Step One: Research was conducted to obtain information on solid waste disposal in Bang Sue District, Bangkok Metropolis, Thailand, employing group discussions with community members and data collection from the field. Step Two: The activities for development of the model consisted of group discussions, workshops, and development of a test of knowledge and behaviors concerning solid waste disposal using the 1A3R practice concept. Step Three : Experimentation with the model consisting of pre – testing and post – testing of knowledge and behaviors concerning solid waste disposal ; door – to – door imparting of appropriate knowledge and behaviors concerning solid waste disposal ; and collecting of data on the rate and amount of generated waste, and waste separation. Step Four: Evaluation of the developed model consisting of assessments based on physical indicators of the waste, opinions of experts, and impacts on participating communities.

The findings revealed that (1) the post – experiment knowledge and behavior mean scores of community members in the sample significantly increased over their pre – experiment counterparts; and (2) the rate of waste generation decreased while waste separation increased.

The proposed model of solid waste reduction and separation was accepted, and has four main components:

(1) Community Practice: solid waste should be separated in the household into three types: food waste, marketable waste and non marketable waste must be clearly separated from household waste.

(2) Knowledge sharing: door – to – door imparting of knowledge and behaviors on solid waste reduction and separation based on the 1A3R practice concept should be promoted.

(3) Community mastery: the community organization must be strengthened by employing active leaders and community members who follow the regulations of waste separation.

(4) Team sharing: the district office or other local agencies should determine the purchasing points with clear purchasing location and time.

Regarding recommendation of the study, a continuous implementation plan for household waste management is needed to ensure that the community has a sustainable waste separation activity through community building.

Keywords: community learning; community strength; community model; solid waste/waste separation; solid waste/ waste reduction

1. Introduction

Developed countries have improved several technologies for solid waste disposal, such as incineration, sanitary landfill and composting. Thailand too has undertaken these technologies for waste disposal for decades. However, waste problems still remain, since much of the waste is only moved from one place to another. No landfill areas are without environmental impact problems. The impacts result in contamination of underground water from landfill leachate in more than 80 % of landfill areas (Department of Environmental Quality Promotion, 2002). Moreover, the landfill technology needs more areas and more funding, and is opposed by the communities surrounding landfill areas.

In the process of incineration of solid waste, dioxins are produced by incomplete combustion. Dioxins are toxic carcinogens acting on the nervous system and the immunological defend systems. Moreover, this toxic substance is stable, (Neal and Schulbel, 1987). Other problems of incinerating kilns are the high price and high cost of operation. The composting process is plagued by heavy metal contamination which end up in fertilizers, and by the nuisance problem of bad smell.

The best practice of solid waste management in developed countries is reduction of waste generated at the source. In addition, the various kinds of

waste are separated. The people must be taught to deal with solid waste by separating it in their homes, schools and work places. In Thailand, the reducing and separating of solid wastes campaign has been criticized for lack of continuity, community public knowledge and community participation. When the campaign moves out, the community behaviors return to the previous practice, where all kind of refuses are dumped into one bin. The HR scholars (Wasi, 1997 and Banyat, 2005) noticed that changing the behavior in a community will be successful, only if the campaign organization has the adequate organization, intellectual capacity, and perseverance.

For these reasons, The Environmental Center of Suan Dusit Rajabhat University cooperated with Bang Sue District, Bangkok in order to study and develop an appropriate model of waste reduction and separation in the community. The ultimate purpose was to develop a model for community participation and knowledge to determine the best alternative models of waste management.

2. Research questions

2.1 How to develop an appropriate model for waste reduction and separation in the community?

2.2 Is the developed model appropriate for the area?

2.3 How to develop a model which is sustainable in the community?

3. Objectives

To study an appropriate model for waste reduction and separation in the community of Bang Sue District, Bangkok Metropolis, Thailand using the learning community concepts.

4. Methodology

A research and development (R&D) study with mixed methodology was conducted (Cresswell, 2003). The research combined quantitative research and qualitative research method in the following four steps.

4.1. To survey community problems and needs with regard to separation and collection of waste by:

1) Group discussions and in-depth interviews in the community focusing on the concerned head officials.

2)Interviews of community people in Bang Sue District.

4.2. To develop the model for solid waste management, based on the data from step one. This will involve:

1) Group discussions among community leaders, the researcher and the coordinators.

2) Group discussions between the concerned head officials and the researcher regarding the model of waste reduction and separation

3) Workshops for the community people to study the developing model.

4.3. To test the model in the field by:

1) Setting the instruments for knowledge and behavior test concerning solid waste disposal using the 1A3R practice concept for pre – test and post – test of community education.

2) Collecting data on the rate and amount of generated waste and waste separation using the 1A3R practice concept for pre – test and post – test of community education.

Meaning of 1A3R:

"Avoid" means to avoid or refrain from using products which are harmful to living organisms, such as pesticides thrown away, and one time used product, such as plastic- cups and spoons.

"Reduce" means the reduction of solid waste by selecting to consume products which produce less waste.

"Reuse" means bring the products back into use over again.

"Recycle" means transformation of the used product material in the same or modified product such as glasses, papers, or plastics.

4.4. To evaluate the model of technology transmission:

1) Comparison of average score of knowledge and behavior for waste separation before and after activity.

2) Physical indicators of waste.

3) Evaluation of model by experts and community.

5. Results of the study

5.1. Problem setting and community needs.

1) Conclusion of group discussions:

(1) The solid waste containers at the collecting site were not enough. Some containers were faulty, cracked, and leaching causing inconvenience to the community.

(2) Communities with no waste collecting trucks have a lot of solid waste storage in the area, causing bad smell and ugliness.

(3) More than half of the communities did not separate solid waste. They dumped all of the wastes into the opened site.

(4) The communities did not have any knowledge of reduction and separation of waste.

(5) The waste collecting trucks of Bang Sue District have been used for more than 10 years, they need more maintenance, and cause collecting problems. The Bangkok Metropolis should budget for new, modern collecting trucks.

2) Quantitative research for studying of the community needs

The structure questionnaire interviews were distributed to randomly chosen 400 households of which 366 replied. The details of data analysis were as follows:

(1) Data on status of housing.

More than half of replies were from women (62.3%). In the groups 20-30, 31-40, and 41-50 years 20-28% responded; below 20 and above 50 years of age 7-9% responded

Education data, 34% of households had passed secondary school level. The others were elementary school level 30%, bachelor degree 17%, diploma 15%, no education 2% and upper bachelor degree 2%.

(2) Data on housing solid waste management

- Solid waste generation

The average number of persons per house was 4 to 5, and on average each person generated 1.2 kg waste/day. –

- Housing generated organic garbage waste

42%. The remainder was plastics 30%, paper 22% and "other non-descript" 4% Small pieces of iron amounted to 2%.

- Data on solid waste separation

More than half of the households had no waste separation. The reasons were lack of bags for waste separation 69%, troublesome, and waste of time 31%.

- Needs for solid waste separation

Approximately half of the households, (49%) needed to separate waste into 3 types, 28% needed to separate into 2 types and 18% needed to separate into 4 types. The rest 5% gave no response. The separations of types were valuable waste, non-valuable waste, and garbage.

- Need of help

The 3 most common suggestions to simplify waste sorting were: get differently colored bags for waste separation 72.40%, differently colored bins 69.40%, and knowledge by demonstration of waste separation 47.26%.

5.2. Setting the model for solid waste separation

Using the findings of step 1 as the fact data, a discussion took place among community leaders, the researchers, the scientists, the head of Environment Section, and the head of the Clean Keeping Section of Bang Sue District for setting a model. The conclusions of discussion were: 1) Set an education program and study the behavior of reduction and separation waste based on 1A3R practice concept by door-to-door contact. 2) Test of knowledge and behavior pre- and post-activity. 3) Study the physical characteristics of waste pre-and post-activity. 4) Set up a workshop for community to search for opinions, models and community selection, using Praram-hok Community to be the example.

5.3. Field work on implementing the test model

1) Comparison of the post-experiment knowledge mean score in reduction and separation waste on the activity of door-to-door imparting significantly increased over pre – experiment at level .01 (Table 1)

2) Study of rate of waste generation and waste separation. Each household was given 3 bags for collection of garbage and after 24 h the bags were collected and weighed. The physical characteristics of the contents were recorded.

Calculation of physical characteristics of waste was processed as follows:

$$\text{Waste generation rate (kg/person/day)} = T_2/T_1 \quad (1)$$

$$\text{Waste separation rate (kg/person/day)} = T_3/T_1 \quad (2)$$

When	T_1 =	Total population at the source of waste generation (persons)
	T_2 =	Total weight of waste at the source of waste generation in 24 hours (kg)
	T_3 =	Total weight of waste separation at the source of waste generation in 24 hours (kg)
Density	=	$(W_1 - W_2)/V$ (3) (kg/L)
Where	W_1 =	weight of a container filled with solid waste (kg)
	W_2 =	weight of an empty container (kg)
	V =	volume of a container (litre)

The essential results are shown in Figure 1 – 3.

Table 1. The mean score of t–test comparison between households without plastic–bags and households with plastic–bags

Variable	Households, without provided bags *(n=50)*				Households, with plastic bags *(n=50)*				Significance
	Pre-test		Post-test		Pre-test		Post-test		
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	
Knowledges									
1.Total mean score	0.74	0.22	0.85	0.29	-	-	-	-	.01
2.Total mean score	-	-	-	-	0.78	0.22	0.86	0.24	.01
3.Total mean score	-	-	0.85	0.29	-	-	0.86	0.24	NS
Behaviors									
1.Total mean score	2.03	0.53	2.13	0.87	-	-	-	-	.01
2.Total mean score	-	-	-	-	2.03	0.53	2.22	0.42	.01
3.Total mean score	-	-	2.13	0.87	-	-	2.22	0.42	.05

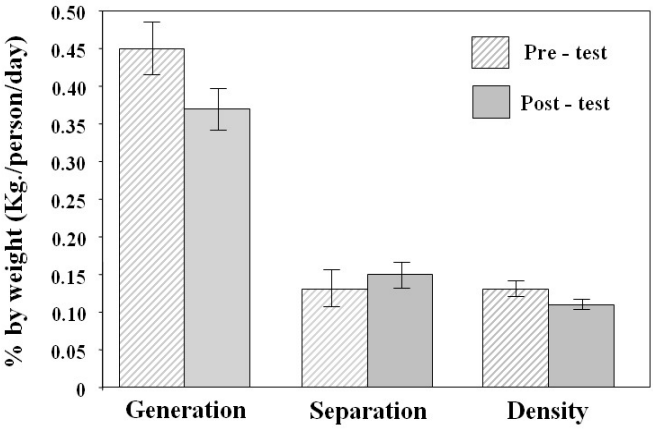

Figure 1. The rate of generation, separation and density of solid waste on pre – test and post – test of 1A3R practice

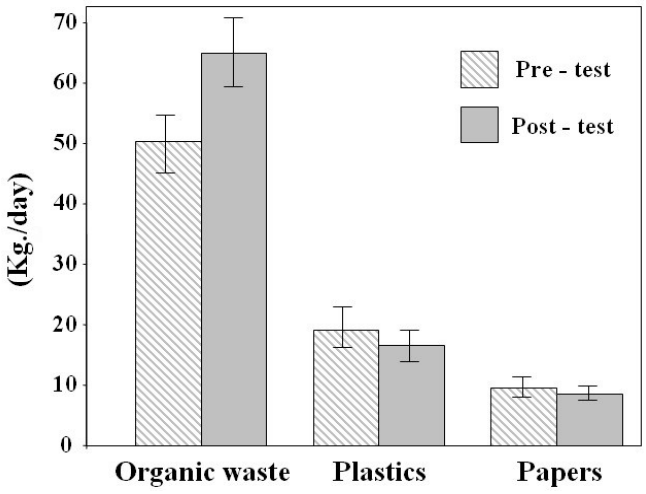

Figure 2. The rate of organic waste, plastics and paper on pre – test and post – test of 1A3R practice

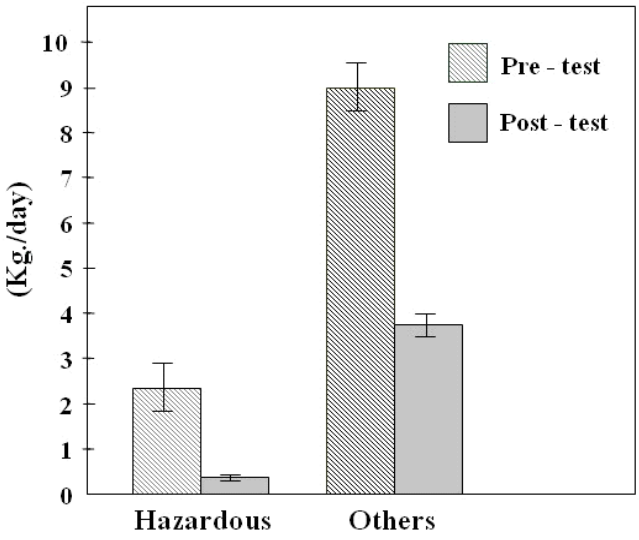

Figure 3. The rate of hazardous waste and others on pre – test and post of 1A3R practice

5.4. Evaluation of the testing model

The effectiveness of the model was shown by the following indicators :

1) Decreasing of solid waste generation and total weight while increasing of separation rate.

2) Community could separate solid waste into 3 types correctly.

3) The post-experiment knowledge and behaviors in waste reduction and separation increased over the pre-experiment.

4) By public hearing, the community was satisfied and agreed to the model and participated the activity.

Experts approved the developing model.

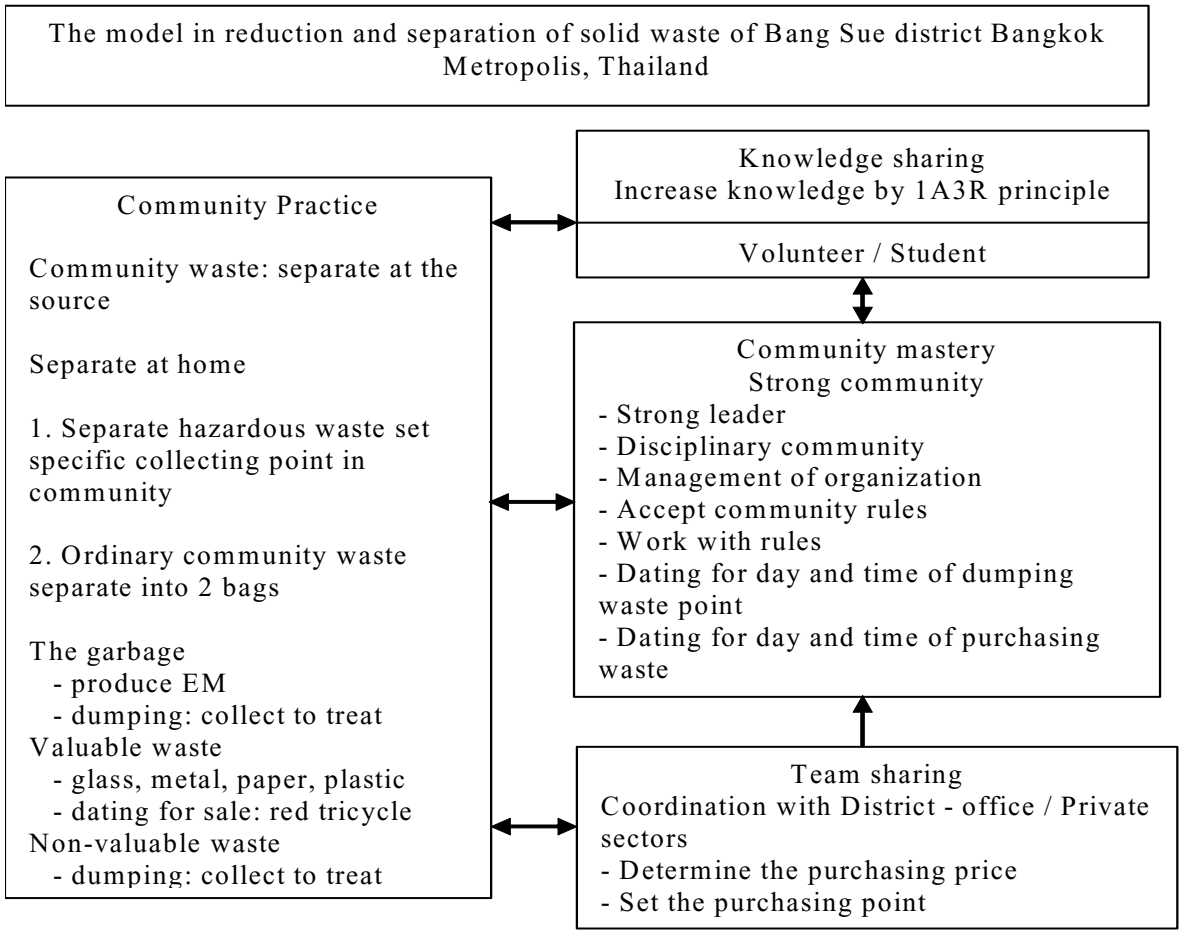

Figure 4. The developed model of reduction and separation solid waste.

6. Conclusion

Developing of model on waste reduction and separation for Bang Sue Community consisted of: four main parts in relation to knowledge management.1. Community practice 2. Knowledge sharing 3. Community mastery and 4. Team sharing. The appropriate model in reduction and separation of solid waste of Bangkok Metropolis community are shown in figure 4.

Knowledge management in terms of community learning which should be considered are dissemination of knowledge of solid waste impact and energy saving. Besides, the enthusiasm of a community should be stimulated by promoting separation benefits, social benefits and environmental benefits. Thus, the key to success for a sustainable developing model should be focused on community learning. A strong community and concerned officers are a basis for continuing activities. In addition, the learning process of people in the community through action is crucial for knowledge management.

7. Recommendation

The Bang Sue District and the related government units should support the construction of a solid waste bank or solid waste recycle center in the community, at least one center per community. Community participation is essential. When the community can operate the activity by themselves, the supporting district and related units should move out, so that the community can take care by themselves. The community solid waste bank in the inner area of Bangkok should have a different structure from the local organization solid waste bank according to the Ministry rules No. 414 (BE. 2542), setting by The City Plan Act BE. 2518 which prohibit land use for purchasing or store materials (Ministry of Interior, 1999). The community solid waste bank in Bang Sue District should have a temporary structure by using community activity area for dating and purchasing separated waste. The hazardous waste must be separated from ordinary waste and collected for ultimate treatment at a hazardous waste treatment center

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