



The Environment Education Model for Sustainable Mangrove Forest Management in the Eastern Part of Thailand

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Abstract

The objectives of this study were to identify factors and environmental education models affecting community participation in sustainable mangrove forest management as well as to develop and evaluate participation in an environmental education model for sustainable mangrove forest management in the eastern part of Thailand. This study employed mixed methods and was divided into 3 steps. First, a quantitative method was used to identify facts and factors affecting local participation in solving mangrove deforestation problems. A multiple-step sampling method was used to select samples of households in the province of Chanthaburi. The second step employed a qualitative method using an environmental education model design. The aim of this step was to analyse an environmental education model for mangrove forest management in successful institutes and discover important compositions of environmental education. In the last step, the environmental education model arranged activities according to the process and was evaluated using a quantitative method for validation, efficiency, and appropriateness.

The findings revealed that: 1) knowledge, understanding and experience in mangrove forest management were the most important factors affecting participation; 2) the most appropriate environmental education model for mangrove forest management in the eastern part of Thailand contained procedures and compositions as objectives of an environmental education model, content regarding mangrove forest management, workshop and evaluation procedures; 3) assessment of the environmental skills for sustainable mangrove forest management. It was found post workshop that the experimental group possessed environmental skills statistically different at 0.05 significance level.

Keywords: Mangrove; forest management; people's awareness; environmental education model

Introduction

Mangrove forests serve as a valuable ecological resource benefitting humans in both directly and indirectly. Mangrove wood has diverse use, and coastal fishing communities are still dependent upon and make their living around mangrove forests. Moreover, mangrove forests have the potential for air and water purification. In Thailand, mangrove forests are distributed along the coasts in the eastern, central, and southern regions of the country, spanning a total of 23 provinces. Thailand has total of approximately 279,041.89 hectares of mangrove forests: 23,015.78 hectares in the eastern region, 9,764.26 hectares in the western and 72,390.73 hectares in the southern [1]. In its last report on the "Thai environmental situation" the World Bank indicated that the area of mangrove forest had decreased to 279,041.89 hectares compared to 372,217.73 hectares in 1961. On Thailand's eastern coast, mangrove forest found in 5 provinces: Trat, Chanthaburi, Rayong, Chachoengsao and Chonburi. According to a survey conducted by the National Research Council and the Department of Forestry in 1975, the total amount of mangrove forest area was 49,575.07 hectares. A survey conducted in 2004 revealed that the area had declined drastically by 53.57% to only 23,016.63 hectares. Loss of mangrove forest areas on the eastern coast can be compared by year as shown in Table 1 below.

From Table 1, Trat province had the largest mangrove forest area in the eastern region, while Chonburi had the smallest area. The largest losses in area were observed in Chanthaburi, which lost approximately 67.8% of its area from 2000 to 2012. Conversion of mangrove forest for aquaculture purposes (mostly prawn breeding) is the major cause of mangrove destruction since 1991, although growth of the industrial sector and residential communities have also contributed to this loss. The loss of mangrove forest areas have

affected the lifestyle of local people living nearby; likewise, the coast as marine resources used for living have decreased as with erosion to riversides, the tide becomes more intense. The impact of the problem of numerous losses of mangrove area has affected local livelihoods and lifestyles as the coastal marine resources on which they had always depended began to decline. Coastal erosion has increased and tide-shave becomes more intense, leading to loss of land.

For these reasons, it is necessary to protect and manage the surviving mangrove forests in the eastern provinces of Thailand. Many policies and measures have been enacted to manage mangrove forest resources in order to increase and restore mangrove forest ecology. Furthermore, the government has issued a policy of integrated mangrove forest management by relying on community participation together with ample government management and an extended role for local administrative organizations. Hence, the eastern provinces are served by various institutes and organizations as well as groups of people or communities who have participated in managing mangrove forests, including provincial natural and environmental resource offices, natural and environmental resource divisions or environmental departments in provincial administrative organizations, and special administrative institutes such as municipality and sub-district administrative organizations. Additionally, mangrove forest management acts were extended to various activities. However, these measures have failed to prevent continuing losses of mangrove forests in the eastern part of Thailand, especially in Chanthaburi, which faces serious problems of forest incursion and deforestation, which are likely only to accelerate in future despite the many measures introduced to protect and manage these ecologically vital natural resources.

In summary, mangrove forest destruction is

mostly the result of human activity. Increased emphasis on environmental education in the eastern part of Thailand has attempted to develop understanding and change behavior to protect the mangroves. A study of the application of environmental education to solve problems including environmental problems in the Sundarban swamp forest in India and in Turkey's national parks revealed that policies and measures already in place inadequately addressed the challenges. Similarly, it was found in Thailand that despite the many measures enacted and reforestation activities initiated in the area of Yeesarn Sub-district, Amphawa District, Samut-Songkhram province, mangrove

areas had been decimated prawn breeding, urban sprawl and cutting, of mangrove wood. Consequently, environmental education was used as a method of developing mangrove forest management. This resulted in successful mangrove forest management in Yeesarn Sub-district. Communities came to understand the benefits of mangrove forests and participated in mangrove forest management, as noted by Sripurjaraen [2]. This paper therefore considers the potential value of a model of non-formal environmental education and its diverse scope and flexibility to address this critically important issue.

Table 1 Mangrove forest area in the eastern part of Thailand

Province/Year	Amount of mangrove forest area (hectares)				
	1996	2000	2002	2004	2012
Trat	7,622.26	9,628.81	8,018.29	10,491.70	779.04
Chanthaburi	3,938.85	12,234.72	7,589.68	9,082.36	3,938.69
Rayong	664.18	1,904.33	962.53	1,691.62	663.70
Chonburi	93.08	722.14	307.57	450.22	93.12
Chachoengsao	488.18	1,767.22	488.18	1,301.30	488.67
Total	12,806.56	26,257.22	16,878.03	23,016.63	12,806.60

Source: National Research Council and Department of Forestry, 2012

Research Objectives and Scope of Study

The study's objectives are defined as follow:

1) To identify key factors influencing people's participation for sustainable mangrove forest management in the eastern part of Thailand.

2) To develop a model for community participation in environmental education for sustainable mangrove forest management in the eastern part of Thailand.

3) To evaluate the model of participation in environmental education for sustainable mangrove forest management in the eastern part of Thailand.

Following these three objectives

The first area of focus scope was to explore key factors influencing people's participation for sustainable mangrove forest management in the eastern part of Thailand. The second was the development of participation in the environmental education model. Third was the evaluation of participation in the environmental education model for sustainable mangrove forest management in the eastern part of Thailand. The target population was the heads of families living in all villages in close proximity to mangrove forest areas in the eastern provinces of Thailand as well as aquatic animal breeders around coastal areas, community leaders, politicians, representatives of private or indepen-

dent institutes related to mangrove forest management and representatives from the government institutes concerned with mangrove forest management.

Conceptual framework

The process for development the environmental education model is outlined as follows: The first step studied the problems of the mangrove forest of communities in the eastern provinces of Thailand, people's awareness of problems, and important factors influencing participation. The second step entailed model development using the environmental education model, academic works, and information interpreted from primary or secondary documents of projects or institutes successful in managing mangrove forest developed appropriately for mangrove forest management. The third step involved testing the environmental education model for mangrove forest management. This step took the environmental education model for mangrove forest management into the environmental education process and inputted factors in terms of heads of families, curriculum, activities, media and technology, understanding, and specialists in environmental education. Before and after environmental education activities evaluation was carried out on knowledge pertaining to mangrove forest management, awareness and sensitivity to mangrove forest problems, supportive attitudes, feelings on mangrove forest management, skills in solving mangrove forest problems, evaluation ability regarding mangrove forest measures and lastly, participatory levels associated with solving mangrove forest issues.

Research methodology

The research procedure was divided into 3 steps as follows:

1) Review of secondary data

The scope of the review was as follows:

(1) Basic information on mangrove forest management of sampled study areas in the eastern provinces.

(2) Key influencing factors affecting people's participation in the sample study areas.

(3) The objective of the review was to support the design of the environmental education model.

A survey was designed and implemented covering the basic information with regards to mangrove forest management in the eastern provinces as follows:

2) Population and sample group

The sample study area was randomised from 5 eastern provinces including Trat, Chanthaburi, Rayong, Chachoengsao, and Chonburi. Random sampling was conducted in Chanthaburi where mangrove forest covered 5 districts: Muang, Lamsing, Tamai, Nayaarm, and Klung. Selection of samples (household representatives) using multiple-step sampling method was carried out as follows:

(1) To come up with a sample of 1 district from 5 target districts using simple random sampling: Lamsing district was selected.

(2) To come up with 1 sub-district from the previously chosen district using simple random sampling: Bangsakao sub-district was selected.

(3) To come up with samples at sub-district level among 681 households in Bangsakao sub-district by applying the formula of Taro Yamane [3]. The sample number was 252 or roughly 300 households.

(4) To separate 300 sample households into representative groups for each village.

(5) To identify target households among sample groups within each village by drawing lots according to the calculated number.

Research tools

Tools consisted of questionnaires and tests, details as follows:

Part 1: General questions about the target group, namely gender, age, occupation, educational level, income, number of family members, period of settlement, size of land possessed, whether or not a social group member, receiving of and source of information and experience of mangrove forest management or conservation.

Part 2: Knowledge test about mangrove forest management or conservation: questions were 10 true–false questions.

Part 3: Evaluation of participation and frequency in mangrove forest management or conservation: questions were multiple choice, (used to, never, and frequency of participation).

Part 4: Interview questions about the development of participation in environmental education for sustainable mangrove forest management in the eastern part of Thailand.

Data collection

2 data types were collected for this part of the study:

1) Secondary data included literature review related to factors affecting humans and mangrove forest management or conservation, information on study area, and relevant research.

2) Primary data from survey of the target area and investigation: 300 heads of families or representatives able to provide information concisely were chosen from the target group living in the target area.

Table 2 Number of target households in each village in Bangsakao sub-district

Mangrove forest area		Number of households (families)	Number of target households (families)
Lamsing district	Bangsakao sub-district		
	Mu.1 (Nern)	225	99
	Mu.2 (Klang)	103	45
	Mu.3 (Nernkland)	96	42
	Mu.4 (Konghin)	153	68
	Mu.5 (Lang)	104	46
Total	5 villages	681	300

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi)

Data analysis

To verify collected questionnaires for completeness and correctness of information the Statistical Package for Social Sciences, SPSS was employed according to the following method:

1) General information of the population included gender, age, occupation, educational level, income, number of family members, period of settlement, size of land holding, receipt of information and information sources, whether or not a social group member, and

experience in mangrove forest management or conservation. Descriptive statistics were calculated including percentages, frequency distribution, means, and standard deviation. Grouping of general information was performed by adding or subtracting means with standard deviation.

2) Information regarding knowledge of mangrove forest management was analyzed using frequency, mean, and standard deviation.

3) Information regarding factors affecting people’s participation behaviour in mangrove

forest management or conservation was analyzed using the Hierarchical Regression method and indicated means and standard deviation. A table was prepared to show factors related to people's participation in mangrove forest management, prediction power of other factors on people's participation in mangrove forest management and regression equation.

Environmental education model design process

The environmental education model design process aimed to:

- 1) Analyze the environmental education model for mangrove forest management within successful institutes.
- 2) Identify the potential components of environmental education and other factors or conditions contributing to the success of the project or institute.

Key Informants

38 representatives from government and private stakeholders in mangrove forest management were selected specifically by purposive sampling.

Development of the Environmental education model for mangrove forest management

Research method as follows:

- 1) To collectively study the successful environmental education model for each project or institute as well as model and important composition of the target institutes or projects successfully implemented for mangrove forest management.
- 2) To collectively analyze the most successful environmental education model of each project or institute i.e. environmental education model used in target institutes or projects discovered to be the most effective for teaching people and leading to behavioural change for mangrove forest management.
- 3) To synthesize an environmental education model appropriate for mangrove forest

management in Chanthaburi.

The information derived from primary study was then incorporate into a new environmental education model under supervision of an expert in mangrove forest management and environmental education. The new model contained key components with common characteristics from the most effective environmental education models of successful institutes or projects. It comprised the following components:

- 1) The mangrove forest management goals and policies were consistent with the government's policies and requirements regarding mangrove forest management and conservation.
- 2) The environmental education model aims articulated the expected results and student outcomes.
- 3) The types and structures of environmental education model signified characteristics and diagrams showing environmental education activities.
- 4) The activity objectives of environmental education articulated the expected results and student outcomes.
- 5) Content specified areas of knowledge, skills, capabilities, and experience required to be learnt by participants.
- 6) Instructional objectives articulated the knowledge, skills, and capabilities necessary to be acquired by participants.
- 7) The activity strategy specified appropriate environmental education activities with regulation for the achievement of learning objectives.
- 8) Evaluation articulated the learning assessment for the improvement, running of activities, and environmental education model.
- 9) Materials and media signified documents, publications, films, CDs, and materials that supported quality and effectiveness of education.
- 10) Context conditions of each project signified special characteristics or limitations that affected the success of the institutes or projects.

Environmental Education Activity and Evaluation of Environmental Education Model

The environmental education activities were implemented according to the process and the content of the environmental education model following evaluation. It aimed to:

1) Analyze and source the environmental education model for mangrove forest management obtained from development.

2) Evaluate efficiency and effectiveness of the model.

Sample Group

The sample group used in the test was one representative from each household in villages situated adjacent to nearby mangrove forest in Chanthaburi (1 village, 40 households).

Experimental Process

The experiment was designed as a single group pre-test/post-test without control group. Before participating in environmental education activities, the samples respondents were asked to complete the pre-test questionnaire. Following participation in project activities, the respondents were requested to complete a post-test.

Data Analysis

Test for the difference of the average achievements of knowledge, understanding on mangrove forest management, awareness, attitude, problem-solving skills, evaluation of ability, and participation in solving mangrove forest issue before and after environmental education activities using paired t-test statistic method.

Research Results

1) Mangrove Forest Management Knowledge

Data on mangrove forest management knowledge were analyzed using a questionnaire comprising 10 questions to measure know-

ledge and understanding in mangrove forest management. It was found that 288 samples had an average knowledge score of 8.04 (from a potential maximum score of 10), with standard deviation of 1.749. When the score of mangrove forest management knowledge was classified into 3 levels based on the group and measured for normal distribution of information using mean and standard deviation, it was found that the majority of the sample (188 respondents) had a medium level of knowledge (65.28%). The next group of samples (67 persons) had a high level of knowledge (23.26%). 33 respondents (11.46%) exhibited a low level of knowledge.

2) Factors Affecting People's Participation in Mangrove Forest Management in Chanthaburi

The survey of 288 respondents indicated that people participated in mangrove forest management in Chanthaburi in recent years on average 2.68 times per year. The average age of respondents was 42.78 years. The average score of knowledge and understanding in mangrove forest management was 8.04 from a total score of 10. The average period of settlement was 27.02 years. The average time of social group membership was 3.54 years. The average experience in mangrove forest management was 2.35 times per year. Average annual household income was 251,848.13 Thai Bath and the average size of land possessed was 1.618 hectares.

In the study on prediction power, demographic independent variables included age, education, knowledge and understanding of mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management. These influenced people's participation in mangrove forest management in Chanthaburi. It was found that demographic factors were able to predict people's participation in mangrove forest management in Chanthaburi at a significance level of 0.05 ($F=9.692$, $P(\text{sig})=0.00$)

and prediction power of 19.50%. When the seven independent factors were considered for each variable, it was found that two independent variables had influence on people's participation in mangrove forest management in Chanthaburi at significance level of 0.05. These were knowledge and understanding in mangrove forest management (Beta=0.13) and experience in mangrove forest management (Beta=0.379) respectively. Meanwhile, the study of prediction power arose from socio-economic independent variables or important factors which included occupation, household income and size of land possessed; all having influence on people's participation in mangrove forest management in Chanthaburi. It was found that the forecasting equation consisted of socio-economic factors able to predict people's participation in mangrove forest management in Chanthaburi at a significance level of 0.05 ($F=2.946$, $P(\text{sig.})=0.008$). Nonetheless, prediction power was low at just 5.90%. When the six independent variables were considered it was found that only one independent variable (household income, Beta=0.149) had the capability of influencing people's participation at a significance level of 0.05.

In the part of the study on prediction power of independent variables or important factors that had influence on people's participation in mangrove forest management in Chanthaburi, two groups of independent variables or important factors consisted of demographic independent variables which were principally, age, education, knowledge and understanding pertaining to mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management, and socio-economic independent variables, namely, occupation, household income, and size of land possessed. It was found that the forecasting equation which consisted of

demographic and socio-economic factors (full model) could be used to predict people's participation in mangrove forest management in Chanthaburi at a significance level of 0.05 ($F=5.942$, $P(\text{sig.})=0.00$). Prediction power was 21.90%. When thirteen variables were considered, it was found that 2 independent variables exhibited influence on people's participation at significance level of 0.05; they were knowledge and understanding of mangrove forest management (Beta=0.13) as well as experience in mangrove forest management (Beta=0.359) respectively. In comparison, for the first model (Model 1), demographic independent factors included education, knowledge and understanding about mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management. In the second model (Model 2), socio-economic independent factors included occupation, household income, and size of land possessed. The third model (Full model) consisted of demographic and socio-economic independent factors. In each model, independent factors (variables) were able to predict people's participation in mangrove forest management in Chanthaburi at a significance level of 0.05. The third model (full model) had the highest prediction power at 21.90%, compared with 2.40% for the first model (Model.1), and 16% for model 2. Comparison of the model indicated that Model 3 (Full Model) was superior to the other two models in predicting people's participation. Model 3 had coefficient in raw score from consisting of constant coefficient 0.187, age coefficient 0.004, primary education coefficient (**edu1**: primary education: higher education) -0.323, secondary education coefficient (**edu2**: secondary education: higher education) 0.03, coefficient of knowledge and understanding in mangrove forest management (**total knowledge**) 0.169, coefficient of period of settlement (**location period**) -0.004, coefficient of social

group membership (**status term**) 0.041, coefficient of experience in mangrove forest management (**activities**) 0.382, coefficient of agricultural occupation (**occupa1**: agriculture: fishery) -0.24, coefficient of employee (**occupa2**: employee: fishery) -0.308, coefficient of trading (**occupa3**: trading: fishery) -0.38, coefficient of other occupations (**occupa4**: other occupations: fishery) -1.268, coefficient of household income (**income**) 0.011, and coefficient of size of land possessed (**area**) 0.011. The forecasting equation could be presented in raw score form as follows. People's participation in mangrove forest management in Chanthaburi, amount of participation = 0.187 (constant) + 0.004*age – 0.323*primary education (**edu1**) + 0.03*secondary education (**edu2**) + 0.169*knowledge and understanding in mangrove forest management (**total knowledge**) – 0.004*period of settlement (**location period**) + 0.041*social group membership (**status term**) + 0.382*experience in mangrove forest management (**activities**) – 0.24*agricultural occupation (**occupa1**) – 0.308*employee (**occupa2**) – 0.38*trading (**occupa3**) – 1.268*other occupation (**occupa4**) + 0.011*household income (**income**) + 0.011*size of land possessed (**area**).

In conclusion, the finding of the primary data indicates that that knowledge and understanding about mangrove forest management and experience in mangrove forest management were important factors affecting people's participation in mangrove forest management in the eastern part of Thailand. Most people had a moderate level of knowledge and understanding of mangrove forest management with an average of 2.35 experiences per year in mangrove forest management.

3) Factors and conditions supporting the project or institute and contributing to successful mangrove forest management

The result from the study of two government institutes, one project and one successful community in mangrove forest management, additional factors and conditions that promoted or supported successful projects and institutes responsible for mangrove forest management included the following:

1) Participation of the community in every process.

2) The characteristic or method in mangrove forest management was not complex and was compatible with the community's lifestyle.

3) The local administrative organizations and local institutes supported or participated in mangrove forest management.

4) The input of institutes or projects which analyzed the situation and offered recommendations to address the problems encountered in mangrove forest management.

4) Appropriate Environmental Education Model for Mangrove Forest Management in the Eastern Part of Thailand

The results from the development of participatory environmental education for sustainable mangrove forest management in the eastern part of Thailand revealed that there are 4 important components making up the participatory environmental education model for sustainable mangrove forest management, namely (1) expected objectives of model; (2) curriculum containing content in relation to mangrove forest management; (3) the activity process (participatory workshop) and (4) assessment to examine the achievement of the environmental education model. Furthermore, augmentation or expansion of other special factors and conditions promoting or supporting the workshop–approach to environmental education for successful mangrove forest management included: participation of the community, activity methods compatible with community lifestyle, the result of activities causing

tangible benefits to the community as well as the local administrative organization and local institutes supporting mangrove forest management.

It was found that the two most important factors affecting people's participation behaviour among numbers of the target group were knowledge and understanding as well as experience in mangrove forest management. The study confirms the key role played by community leaders.

5) Preparation of Environmental Education Activity and Evaluation of Environmental Education Model

It was found as expected that respondents had greater knowledge post workshop, with an average score of 0.48 using the Paired t-test statistic, the average post-workshop respondents attitudes score improve to 3.98. Similarly, post-workshop awareness score also increased to an average 4.63 using the Paired t-test statistic. To compare the improvement in problem-solving skills, the Paired t-test statistic revealed, post-workshop scores for problem-solving skills had improved to an average of 4.23. Participation level and evaluation ability also improved, with an average post-workshop score of 1.53 and 3.90 respectively. All the above differences were significant at $P = 0.05$.

6) Procedure for Determination of Community Regulations and Local Plans Derived from Participation in the Environmental Education Model for Sustainable Mangrove Forest Management in the Eastern Part of Thailand

After administrating participation in environmental education activities for sustainable mangrove forest management in Sanamchai sub-district, Nayaarm district, Chanthaburi, the workshop result in the following key outputs:

1) The community's mutual agreements or regulations for mangrove forest management.

2) The plan of the community or project incorporated in the plan of the local sub-district administrative organization.

Discussion

1) Important Factors Affecting People's Participation in Sustainable Mangrove Forest Management in the Eastern Part of Thailand

The study of key factors influencing people's participation in mangrove forest management in the eastern part of Thailand, found that knowledge and understanding of mangrove forest management and direct experience in mangrove forest management were the two most significant factors affecting individual participation in local mangrove forest management. However, research by Rakchart [4], highlights that other factors may also be significant, including education level, period of settlement, primary occupation, household income, size of land holding, level of training, experience in mangrove forest management and experience in working with government officers. A separate study by Worrakupboonya [5] stated that social and economic factors also influence, i.e. age, level of education, occupation, and being member of a social group.

2) Environmental Education for Sustainable Mangrove Forest Management in the Eastern Part of Thailand

The study also finding also indicate that the most effective environmental education model was non-formal environmental education in workshop form. Important components included content, objectives, government policies regarding mangrove forest, purpose of environmental education, activity strategy, and evaluation. This finding corresponds with those of Chunkao [6], who found that a workshop was an effective form of non-formal environmental education when implemented to

establish best practice and resolve problems at the local level. The consensus-based approach results in broad acceptance by the community, increasing the livelihood of success. Other important factors and conditions supporting successful mangrove forest management included the community's participation in every step of the forest management process, combined with a simple forest management plan that is compatible with the local community lifestyle and needs. These findings are also consistent with the research of Maturamon [7] who found that participation or support of the people or target group in successful activities was increased when the target group learned and fully understood the objectives and strategy of the operation.

3) Administration and Evaluation of Environmental Education Activity

This was a test of participation in environmental education for sustainable mangrove forest management. In Sanamchai sub-district, which was chosen for environmental education for mangrove forest management, key influencing factors were target population, environmental education project and activities. In addition, environmentalists were brought into the environmental education process. Then, the effectiveness of the model was evaluated. The results showed that the participation in environmental education model (workshop) was able to enhance knowledge, attitude, awareness, problem-solving skills, evaluation ability, and participation in mangrove forest management. These findings correlate with research by Srisuphan [8] which revealed that after the collective activity of professional practitioners specialized in garbage eradication i.e. seminars, opinion exchange and networking, the group had increased knowledge, attitude, and problem-solving skills.

Conclusions

In conclusion, analysis of the primary data established that knowledge and understanding of mangrove forest management and experience in mangrove forest management were the important factors influencing people's participation in mangrove forest management in the eastern part of Thailand. The development of the environmental education model for sustainable mangrove forest management contained the objectives of environmental education, curriculum, activity process, evaluation and other special factors or conditions.

In the part of evaluation of the environmental education model it was found that knowledge, attitude, awareness, problem-solving skills, evaluation ability and participation in mangrove forest management before and after environmental education were significantly different. This implies that the developed environmental education model effectively increased knowledge, attitude, awareness, problem-solving skills, evaluation ability and participation in mangrove forest management.

Policy Recommendation

From the findings of this study, for the success of mangrove forest preservation, participation of people in the communities concerned should be fostered and encouraged, empowering local people and communities to protect and conserve their local mangrove forests. In addition, management knowledge should also be provided to such communities on a regular basis.

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