THE DEVELOPMENT OF PARTICIPATED ENVIRONMENTAL EDUCATION MODEL FOR SUSTAINABLE MANGROVE FOREST MANAGEMENT ON EASTERN PART OF THAILAND

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This thesis entitled The development of participated environmental education model for sustainable mangrove forest management on eastern coast of Thailand was established by concerning about mangrove deforestation from researcher who settled in local community of Chanthaburi that is a province on eastern part of Thailand. My life related to mangrove forest very much because my family was very poor, therefore my family utilized mangrove forest for food and many things in existence.

Form the reason aforementioned, I could visualize many changes of mangrove forest in the past to the present that was the continuous and enormous deforestation while the government was attending to protect the sustainable mangrove forest. The continuous deprivation of the mangrove forest was the important question for me what appropriated for sustainable mangrove forest and became to this research.

My thesis was achieved because of their kindness and active consulted of Dr.Pattaboon Pichayapaiboon, my thesis major advisor, Assoc.Prof. Dr.Chumlong Arunlertaree and Dr.Prontida Visaetsilapanonta, my thesis co-advisor, All those influenced this research final report and I would like to give special thank for their all kindness.

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ABSTRACT

The objectives of this study were to find factors and environmental education models affecting the participation of people in sustainable mangrove forest management to develop and to evaluate participated environmental education model for sustainable mangrove forest management in the eastern part of Thailand. This study employed the mixed method and was divided into 3 steps. In the first step, the quantitative method was used for studying facts and factors affecting participation of people to solve mangrove deforestation. The result of the study area sampling was Chanthaburi and selected the samples as household representatives by using multiple-step sampling method. The second step employed the qualitative method for environmental education models design process aimed to analyze environmental education model for mangrove forest management in successful institutes and find important compositions of environmental education. In the last step, the environmental education model arranged activities according to the process and evaluated by quantitative method for validation, efficiency, and appropriateness.

Research findings revealed that :

1) Knowledge, understanding and experience in mangrove forest management were important factors affecting the participation of people in mangrove forest management in the eastern part of Thailand.

2) The most appropriate environmental education model for mangrove forest management in the eastern part of Thailand contained the procedures and compositions as objective of environmental education model, content about mangrove forest management, workshop, evaluation, and special factors.

KEY WORDS: MODEL / ENVIRONMENTAL EDUCATION

182 pages

การพัฒนารูปแบบสิ่งแวดล้อมศึกษาอย่างมีส่วนร่วมเพื่อการจัดการป่าชายเลนอย่างยั่งยืนแถบชายฝั่งทะเลตะวันออกของประเทศไทย

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อค้นหาปัจจัยสำคัญที่ส่งผลต่อการมีส่วนร่วมของประชาชนเพื่อการจัดการป่าชายเลนอย่างยั่งยืนและรูปแบบสิ่งแวดล้อมศึกษาอย่างมีส่วนร่วมเพื่อการจัดการป่าชายเลนอย่างยั่งยืนรวมไปถึงการประเมินผลรูปแบบสิ่งแวดล้อมศึกษาอย่างมีส่วนร่วมเพื่อการจัดการป่าชายเลนอย่างยั่งยืน แถบชายฝั่งทะเลตะวันออกของไทย วิธีการศึกษาวิจัยใช้ระเบียบวิธีการวิจัยแบบผสมผสาน โดยแบ่งการศึกษาทั้งหมดออกเป็น 3 ขั้นตอนดังนี้

ขั้นตอนที่ 1 ใช้ระเบียบวิธีวิจัยเชิงปริมาณศึกษาข้อมูลพื้นฐานของการจัดการป่าชายเลนและปัจจัยสำคัญที่ส่งผลต่อการมีส่วนร่วมของประชาชนในการจัดการป่าชายเลนของ 5 จังหวัดในภาคตะวันออกโดยใช้แบบสอบถามและแบบทดสอบโดยใช้โปรแกรมสำเร็จรูปสำหรับงานวิจัยทางสังคมศาสตร์ (SPSS) ในการวิเคราะห์ข้อมูล พบว่าความรู้และความเข้าใจในการจัดการป่าชายเลนและการมีประสบการณ์ในการจัดการ ป่าชายเลนของประชาชนเป็นปัจจัยสำคัญที่ส่งผลต่อการมีส่วนร่วมในการจัดการป่าชายเลนของประชาชน

ขั้นตอนที่ 2 การออกแบบรูปแบบสิ่งแวดล้อมศึกษา โดยใช้วิธีการวิจัยเชิงคุณภาพในการวิเคราะห์และพัฒนารูปแบบสิ่งแวดล้อมศึกษาจากโครงการเป้าหมาย 4 โครงการที่ประสบความสำเร็จในการจัดการป่าชายเลน พบว่า มี 5 องค์ประกอบสำคัญของรูปแบบสิ่งแวดล้อมศึกษาอย่างมีส่วนร่วมเพื่อการจัดการป่าชายเลนอย่างยั่งยืนประกอบด้วย จุดมุ่งหมาย สาระสำคัญ วิธีดำเนินการ การประเมินผลและเงื่อนไขพิเศษ

ขั้นตอนที่ 3เป็นขั้นการจัดกิจกรรมสิ่งแวดล้อมศึกษาและประเมินผลรูปแบบสิ่งแวดล้อมศึกษาโดยใช้ระเบียบวิธีวิจัยเชิงปริมาณทดสอบความแตกต่างของคะแนนเฉลี่ยผลสัมฤทธิ์ของความรู้ ความตระหนัก เจตคติ ทักษะในการแก้ปัญหา ความสามารถในการประเมินผลและการเข้ามามีส่วนร่วม กลุ่มเป้าหมายเป็นผู้นำชุมชน จำนวน 40 คน ในพื้นที่ตำบลสนามไชย อำเภอนายายอาม จังหวัดจันทบุรี พบว่า รูปแบบสิ่งแวดล้อมศึกษาดังกล่าวมีประสิทธิผล

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UN	The United Nation Organization
UNEP	The United Nation Environment Programme
UNESCO	The United Nation Education Science and Culture Organization
PAR	Participatory Action Research
S.D.	Standard Deviation
IOC	Index of Item Objective Congruence
AIC	Appreciation Integration and Contribution: A Participation Technique

CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

Mangrove forest is valuable ecology beneficial for human living in both direct and indirect ways. It can be classified into 3 aspects. The first aspect is about economic value from the use of mangrove wood in different forms, such as firewood and charcoal, fishery, and tourism location. The second aspect is about social value. Coastal fishing communities still depend and make their living around mangrove forests. They have harmonious lifestyle, leading to local culture. They care and help one another. The last aspect is environmental value. Plants in mangrove forest have potential in air purification like other plants. Moreover, it is also spawning area and habitat of young aquatic animals as well as the capability to prevent coastal erosion , tide and wind from natural disaster (Department of Marine and Coastal Resources, 2008:7-9).

The total area of mangrove forest across the world occupies 113.43 million rai approximately. They spread in 3 major tropical zones. The first zone is Asian tropical area, occupying 52.56 million rai approximately or 46.40% of total mangrove forests. The second zone is American tropical area, occupying 39.60 million approximately or 34.90% of total mangrove forests. The last zone is African tropical area. It has the least mangrove forest area, occupying 21.63 million rai approximately or 18.70% of total mangrove forest areas. The country with the most mangrove forest area in the world is Indonesia. It occupies 26.57 million rai approximately. The next countries are Brazil, occupying 15.63 million rai approximately, and Australia, occupying 7.19 million rai approximately respectively (Department of Marine and Coastal Resources, 2007:15-18).

In Thailand, mangrove forests spread across the coasts in the eastern part, the central part, and the southern part, totally 23 provinces. From the survey conducted by Department of Forestry in 2004, it was found that Thailand had mangrove forest

totally 1,723,781.25 rai. Eastern part occupies 142,181.25 rai. Central part occupies 60,318.75 rai. In southern part, gulf of Thailand occupies 447,193.75 rai and the west coast occupies 1,074,087.50 rai. The province with the most mangrove forest area in Thailand is Phangnga, occupying 260,693.75 rai. The next provinces are Krabi, occupying 218,837.50 rai and Satun, occupying 217,006.25 rai (Department of Marine and Coastal Resources, 2007:19-22).

In conclusion of the latest "Thai environmental situation report" (2007) of World Bank, the report produced in collaboration of Department of Marine and Coastal Resources and environmental representatives of the Work Bank stationed in Thailand. One main point of this report indicates that many parts of damp mangrove forest area have been destroyed currently. The condition of mangrove forest is in crisis since numerous mangrove areas have been deteriorated. And many of the rest have been affected and deteriorated. The areas are decreasing annually. Corresponding to the report of Department of Marine and Coastal Resources (2007), it explains that Thailand has the ninth most mangrove forest area in Asian tropical zone. From coastal areas in 24 provinces of Thailand, which is approximately 2,614 kilometers in length, mangrove forest area occupies 36% of total coastal length. However, the latest survey of Department of Forestry in 2004 is being used as current reference since the scope of survey on mangrove forest area ranges from 3 to 5 years. It was found that the area of mangrove forest had decreased to 1,723,781.25 rai comparing to the survey conducted in 1961, indicating the area of mangrove forest at 2,299,375 rai. Without systemic management, mangrove forest will be destroyed and deteriorated increasingly. In addition, there is supporting information depicting the current crisis of mangrove forest areas in Thailand from Sanit Aksornkaew (1998) as follows.

During 2504 – 2518, the area of mangrove forest decreased at 345,000 rai or 24, 643 rai per year on average.

During 2518 – 2522, the area of mangrove forest decreased at 158,700 rai or 39,675 rai per year on average.

During 2522 – 2529, the area of mangrove forest decreased at 568,001 rai or 81,143 rai per year on average.

During 2529 – 2532, the area of mangrove forest decreased at 99,153 rai or 33,060 rai per year on average.

During 2504 – 2532, the area of mangrove forest was destroyed at 1,170,881 rai, accounting to 50.93% of mangrove forest area in 1961 or average deterioration rate at 41,817 rai per year approximately. The important reason of the decrease of mangrove forest area in late 1979 was due to attentiveness in coastal aquaculture, especially in invading mangrove forest area for prawn cultivation. Due to high return on investment and short payback period, prawn breeding business expands rapidly. The area of prawn farms increased from 162,725 in 1979 to more than 600,000 rai in 1986 or 64.30% of total destroyed mangrove forest areas. About utilization of mangrove forest area for other activities, such as mining, salt farm, agriculture, community growth, building piers, roads, electricity posts, factories, and dredging watercourses, there were not much growth. During 1980 – 1986, total destroyed mangoes forest area was approximately 328,581 rai or about 35.70%.

Furthermore, it was found that during 2004 – 2012, there were invasions into mangoes forests for prawn farming, building factories and deep-water ports, losing over 600,000 rai of the forest. From the survey and data collection about mangrove forest area of Department of Forestry in 2012, the remaining area of mangrove forests is as shown in Table 1.1.

Table 1.1 Information of mangrove forest during 1996 – 2012 (by region)

Region	Amount of area (rai)				
	Year 1996	Year 1998	Year 2000	Year 2004	Year 2012
Eastern part	79,112.50	79,112.50	165,204.00	142,181.25	79,112.50
Central part	34,056.75	34,056.25	67,962.00	60,318.75	34,056.25
Southern part (gulf of Thailand)	103,570.50	103,568.75	212,894.00	447,193.75	103,568.75
Southern part (western coast)	830,650.00	830,650.00	1,133,633.00	1,074,087.50	821,900.00
Total area	1,047,390.00	1,047,387.50	1,579,693.00	1,723,781.25	1,038,637.50

Source: National Research Council and the Department of Forestry, 2012

From Table 1, it can be found that the total area of mangrove forest across Thailand in 2012 has decreased to only 1,038,637.50 rai. Most mangrove forest areas are in southern part (western coast) of the country, totally 821,900.00 rai.

The provinces that have lost the most mangrove forest area include Samutprakan, Samutsongkhram, Samutsakhon, Satun, Nakhonsithammarat, and Suratthani. The ministry determined clearly not to use mangrove forest in any case. The time from now on is for restoration only (Sanit Aksornkaew, 2004:1-7).

The current remaining area of mangrove forest is approximately 1,038,637.5 rai according to the information of National Research Council and the Department of Forestry. High trend in the loss of such area was due to 5 major causes, namely bad management of mangrove forest, utilization of mangrove forest that is not based on permanency, insufficient participation of the people, relevant organizations and rules that are not corresponding to current mangrove forest situation, and misinterpretation of satellite images (interview with academician of Department of Marine and Coastal Resources, 2009).

From the mention above, the important cause in the loss of mangrove forest area in Thailand, including bad management of mangrove forest, utilization of mangrove forest that is not based on permanency, and insufficient participation of the people, are adverse behaviors affecting to mangrove forest or the environment.

Mangrove forests in eastern coast of Thailand occupy the area in 5 provinces, namely Trat, Chanthaburi, Rayong, Chachoengsao, and Chonburi. From the survey conducted by National Research Council and the Department of Forestry in 1975, it was found that Trat's mangrove forest occupied 66,250.00 rai. Chanthaburi's mangrove forest occupied 163,125.00 rai. Rayong's mangrove forest occupied 34,375.00 rai. Chon Buri's mangrove forest occupied 23,750.00 rai. Chachoengsao's mangrove forest occupied 18,750.00 rai. The total amount of mangrove forest area is 306,250.00 rai. Later in 2004, the latest survey was conducted. This information is present reference since survey cycle ranges from 3 to 5 years. It was found that Trat's mangrove forest occupied 64,812.50 rai. Chanthaburi's mangrove forest occupied 56,106.25 rai. Rayong's mangrove forest occupied 10,450.00 rai. Chonburi's mangrove forest occupied 2,781.25 rai. Chachoengsao's mangrove forest occupied 8,031.25 rai. The total amount of mangrove forest area in 2004 was 142,181.25 rai.

The amount of mangrove forest area loss since 1975 is 164,068.75 rai, or 53.57% of mangrove forest area in 1975. Such loss of mangrove forest areas in eastern cost can be compared by year as shown in Table 1.2.

Table 1.2 Mangrove forest areas in eastern part of Thailand

Province	Amount of mangrove forest area (rai)				
	Year 1996	Year 2000	Year 2002	Year 2004	Year 2012
Trat	47,086.50	59,482.00	49,533.00	64,812.50	47,087.50
Chanthaburi	24,332.25	75,580.00	46,885.25	56,106.25	24,331.25
Rayong	4,103.00	11,764.00	5,946.00	10,450.00	4,100.00
Chonburi	575.00	4,461.00	1,900.00	2,781.25	575.25
Chachoengsao	3,015.75	10,917.00	3,015.75	8,031.25	3,018.75
Total	79,112.50	162,204.00	104,264.00	142,181.25	79,112.75

Source: National Research Council and the Department of Forestry, 2012

From table 1.2, in 2012, the province with the most mangrove forest area in eastern part of Thailand is Trat. It has remaining mangrove forest area 47,087.50 rai. The province with the least mangrove forest area is Chonburi. It has remaining mangrove forest area 575.25 rai. **The province that has lost the most mangrove forest area is Chanthaburi, such amount 51,248.75 rai or 67.8% of the former area in 2000.**

The important cause in the loss of mangrove forest area in eastern coast of Thailand since 1991 is due to the change of mangrove forest area for aquaculture purpose, mostly prawn breeding. Because the eastern cost is appropriate for sea prawn, an economic animal is worthy for breeding investment. Therefore, sea prawn breeding grows rapidly. In addition, the government to support in prawn breeding for national revenue, Chanthaburi has the most prawn breeding area in the country. The loss of mangrove forest area was not considered. After certain period of prawn breeding, the environment around prawn breading area will no longer appropriate for prawn breeding due to accumulation of toxins used in prawn breeding activities. Finding for new location for breeding is necessary in order to maintain production amount in the market. Thus, more mangrove forest areas are being invaded increasingly. In addition,

the growth of industrial sector and communities highly decrease mangrove forest area. From the survey of mangrove forest area in 2012, mangrove forest area remains only 79,112.75 rai (National Research Council and the Department of Forestry, 2012).

The result from numerous losses of mangrove forest areas as well as abandoned mangrove forest is due to deterioration and accumulated toxins caused by sea prawn breeding. This affects to lifestyle of local people living nearby mangrove forest or the coast. Marine resources used for living, such as fishes, crabs, shrimps, clams, etc. have decreased in number. About erosion on riverside, the tide becomes more intense. Tide and wind blowing the coast are strong until they cause damage to coastal communities. Institutes related to mangrove forest are turning back to mangrove forests in eastern part, which are in crisis due to unbalanced coastal environment. Therefore, since 1994, provinces in eastern part with mangrove forests ran the campaign for forestation and mangrove forest restoration by government and private institutes seriously and continuously. Furthermore, at that time, the government and Department of Forestry issued different measures to maintain mangrove forest area, for example, cancellation mangrove forest concession, determining the zone for activities that affect to mangrove forest and reforestation by the support of government budget. These have increased the amount of mangrove forest area to 162,204.00 rai from the survey in 2000.

At the same time, since mangrove forest had become more abundant in 2000, ecology of mangrove forest had been restored. The condition of the area was appropriate for prawn breeding again. Moreover, prawn breeding techniques were being developed continuously, so sea prawn breeding had lower risk of loss and low death rate. Food markets, including America, Europe, and Asia, need sea food at high amount. Therefore, sea prawn breeding boomed again. In addition, many big companies invested in sea prawn breeding. Former reforested mangrove forests of private sector were used as sea prawn breeding area again. Measures and regulations were ignored or neglected by many sides. Mangrove forest areas were extensively invaded until mangrove forest area in eastern part surveyed in 2002 was decreased to only 104,264.00 rai.

The impact from the decrease of mangrove forest causes human to lose their huge fortress, which is important in preventing wind and tide. Root system of mangrove helps entrap diffuse dirt to make it precipitate and combine together, resisting against erosion. When mangrove forest has been destroyed, wind and tide will crash and erode the coast strongly. Moreover, precipitation of dirt cannot happen, causing coastal area to decrease continuously. Erosion on the coast destroys coastal ecology and lives, such as sea grass, coral reefs. This deteriorates the natural abundance of coastal ecology. Such circumstance lowers the function of carbon dioxide absorption, waste water toxin absorption and the amount of important food source.

The problem of coastal erosion causes coastal area to lose its fertility as breeding and nurturing site of aquatic animals, such as crabs, fishes, prawns, clams, and other animals. These aquatic animals are considered economic animals because Thailand's aquatic animal trading cost a lot of money each year. Thus, these aquatic animals are decreasing in number until fishermen or fishing businesspersons can no longer run their businesses. Then the people lose their income as well as national revenue. Moreover, the waste of natural fertility and beautiful scenery reduces the number of tourists, affecting tourism industry, which is currently considered as the main source of national income. This decreases the income of communities and businesspersons as well as national revenue.

Most local communities on the coast have their lifestyle related to mangrove forest and the sea. When they lost coastal area, they also lost their homes and land until they cannot live in the place as before. They have to move to another place. This changes the community's original culture since they have to adapt to new environment (National Resources and Environmental Policy and Planning Office, 2007).

The impact mentioned above happened to people living in mangrove forest areas in eastern provinces corresponding to the condition and amount of the loss in mangrove forest in each area.

From such reason, it is necessary to manage mangrove forest in eastern provinces appropriately. Many policies and measures have been determined to manage mangrove forest resource in order to increase and restore mangrove forest ecology. These include classifying mangrove forest into conservation and business zones,

prohibiting the use of mangrove forest area strictly, and cancelling mangrove forest concession, and establishing sub-institutes to manage local mangrove forests. This consists of 1st mangrove forest management unit (Chonburi), 1st mangrove forest development station (Rayong), 3rd mangrove forest development station (Klung, Chanthaburi), 4th mangrove forest development station (Namcheaw, Trat), and special projects, such as the study project on the development of Kungkraben Bay in royal idea. It collectively conduct conservation and restoration activities on mangrove forests, including determining conservation measure and planning for mangrove forest resource management, study, analyze, research and plan for land utilization for conservation and restoration of mangrove forest that affect to the environment and ecology, consult, recommend and disseminate knowledge and technologies about mangrove forest, management for conservation, restoration, prevention, and suppression of mangrove forest destruction, coordination with related institutes, as well as supportive operation with other relevant or assigned institutes (Department of Marine and Coastal Resources, 2008:20-23).

Later, the government issued the policy of integrated mangrove forest management by relying on community's participation together with good government's management and extended role of local administrative organization. Therefore, eastern provinces have various institutes and organizations as well as the groups of people or communities participated in managing mangrove forest, including provincial natural and environmental resources office, natural and environmental resources division or environment department in provincial administrative organization, special administrative institute, such as municipality, sub-district administrative organization. These institutes have their roles and responsibilities in managing mangrove forest according to supportive legal framework. They have different mangrove forest management means corresponding to local condition. They appear in different forms, for instance, creating community's awareness so that they care for resources, to Issue and to determine regulations for sustainable utilization, to Protect and to guard mangrove forest and coastal resources, to grow and to restore deteriorated forests, to Increase biological diversity in mangrove forest ecology, to Develop learning center by using natural materials and provide ecological tourism location. Mangrove forest management in eastern part increasingly directs toward

local community's participation. This is because the communities are directly affected. They are close and understand about their local natural resources. They have increasing roles and potential. In addition, mangrove forest conservation activities extend to various activities. The communities intensively participate in mobilization. From serious operation, the amount of mangrove forest area surveyed in 2004 was increased to 142,181.25 rai.

However, the tendency of the loss in mangrove forest left in Chanthaburi still remains. As stated by Samran Rakchart, the director-general of Department of Marine and Coastal Resources, Chanthaburi and Trat have so many prawn farms. In Chanthaburi, it had more than two hundred thousand rai in the past. But now they have only sixty thousand rai. The rest of the area has become prawn farms (Matichon, 20th December 2008).

Various information indicates that mangrove forest areas on eastern coast of Thailand, **especially in Chanthaburi, are facing problem of invasion and deforestation. It tends to lose more mangrove forest areas.** This is mostly done by human and the problem must be urgently solved.

Other countries in Asian tropical area have similar or different management comparing to Thailand. It can be briefly concluded as follows. Philippines have issued laws and regulations consisting of mangrove forest protection measures. It determines requirements that must be operated in order to replenish or restore lost mangrove forest, including reforestation, restoration of deteriorated mangrove forest. Furthermore, it supports communities to create their regulations in managing local mangrove forest. Malaysia has also established national mangrove forest policies as well as legislation. It allows local administrative organizations to participate at state level. In addition, there are projects that reforest destroyed mangrove forest. Indonesia has established the policies to address with mangrove forest in national level and put the policies in to practice in localities. It emphasizes on policy coordination, aiming toward economic development. It uses mangrove forest management strategy based on community's norm. India has declared some mangrove forests as conservation area. It encourages the people living nearby mangrove forest to lower the use of mangrove wood and other woods in the forest. It also encourages the community to participate more in conserving and managing mangrove forest. India's

neighboring country, Bangladesh, has determined policies and plans in managing mangrove forest by the government. This includes the issue of laws and regulations for substantial management activities, including regulation for commercial logging, reforestation on deteriorated area. Moreover, it is found that many Asian countries have applied satellite information for mangrove forest management, such as Vietnam, United Arab Emirates, India, and Bangladesh.

About countries in America continent, United States has developed the policies for managing mangrove forest, verifying the projects approved to conduct in mangrove forest area, training for related officers, following up project results associated with mangrove forest, enforcing the law, applying mangrove forest management process as well as the application of engineering knowledge and hydrology to manage and restore mangrove forest by leveling the land, digging canals and watercourses to adjust water level in mangrove forest area. Brazil has issued the rules and regulations for logging in mangrove forest according to ecological system, for example, the size of tree, replacement age range, announcing conservation zone for mangrove forest, developing mangrove forest development plan by relying on integration from many sides, encouraging the community or locality to issue rules or regulation for local mangrove forest management, and using satellite images to manage mangrove forest resources. Venezuela has issued the law consisting of measures for preventing the loss of mangrove forest area. It determines necessities for the operation as replacement or substitution for lost mangrove forest area.

The information suggests that in the past Thailand and foreign countries with mangrove forests had measures in place to maintain and manage the forest. However, they were not able to decrease the destruction of mangrove forests done by human. Thus, mangrove forests lost their balance until they cannot function anymore. This highly affects to ecology and human living.

The problem about mangrove forest management of Chanthaburi is mostly caused by people's behaviors or actions. Good solution directing to the point is to focus on the adjustment of such troublesome behaviors or actions. At the same time, environmental education is the process that develops people's understanding. Education leads to behavioral change, which does not damage the environment. They are able to live with the environment permanently. Such environmental education has

procedure, direction and specific content. There are 3 important and consistent principles as follows. The first principle is about environmental content that is profound in specific topic as well as relationship with other things. The knowledge must be followed in both the concept and method. Finally, the content must provide correct skills. The second principle is about environmental dissemination technology. That means environmental knowledge passes through the tools to the learners. The tools consist of 4 main parts, including: (1) Curriculum and content easily understandable for the learners (2) Tools and materials as appropriate (3) Personnel that provide environmental knowledge. They must have comprehensive knowledge and communication skill. (4) Educational process and strategy. The last principle is that target population, who receive the knowledge, or learners must be able to learn, analyze, evaluate, and synthesis. At the same time, study environment is also important in 2 objectives. The first objective is to instruct and teach about environment, environmental problems, and analysis on the impact obtained from environmental problems. The second objective is to adjust behavior under self-control in order to maintain balanced environmental condition.

Learning process through environmental education is based on assumption that we can implant human behavior if the instructor is able to manage the activity or experience appropriately according to the content, knowledge and interest of the learner. Emphasize on behavioral change of the learner. In learning process of environmental education, the learner or participant attended environmental education activity should meet the following criterions. 1) The learner know the fact about environment, such as natural unbalance of mangrove forest, which affect to aquatic animals and human 2) The learner have the idea after receiving enough information about environment. He or she will understand current environmental topic immediately after completion of environmental education activity or environmental education learning. 3) The learner is able to analyze and differentiate new environmental problem regarding to the cause, impact, and solution for such problem. 4) When the learner or the person, who has passed environmental education process, understands environmental problem in various aspects, he or she will see the problem, obstacle as well as disadvantage of troubles that might arise in the present and in the future on oneself and other surrounding people. This is awareness. Thus, one will make decision on solving problem personally or

together with other persons in order to retrieve desirable environment. 5) Since the learner has retained many knowledge and facts, he or she will realize about one's own risky behaviors. So these behaviors should be changed in order to avoid dangers. Finally, 6) the change of social's behavior is on macro level, leading to well-being of the society. This takes time for the change.

The loss of mangrove forest area on eastern coast is mostly caused by the action of human. This indicates the lack of knowledge and understanding about mangrove forest, which is behind their action. Therefore, to solve mangrove forest problem, we must teach about mangrove forest to the people. Teaching them will lead to behavioral change, which is not adverse to the environment. The process used to create understanding about mangrove forest is called environmental education.

From the study on the application of environmental education to solve problems, including environmental problems, such as Sundarban swamp forest in India, solving environmental problem in Turkey's national park, it was found that although the government of relevant institutes had various policies for solving problem, finally, environmental education was found as good and permanent solution. Environmental education was also applied for solving social problem. It was found that it was used to solve poverty in Ethiopia. The solution was regarding to correct and appropriate land utilization (S.Bekalo, C.Bangay, 2002).

Interestingly, it was found that mangrove forest in the area of Yeesarn, Amphawa, Samutsongkhram highly decreased due to prawn breeding, the extension of housing, and the use of mangrove wood for other utilizations. Although the government had conducted activities, created legal measures, and supported reforestation, the situation was not getting better. Therefore, the researcher is interested in the better method that will make mangrove forest management effective and efficient. From research for many methods, finally, the researcher has selected environmental education as the method in developing mangrove forest management for local community at Yeesarn, Amphawa, Samutsongkhram. The study showed that the persons, who had passed environmental education process by using media, such as manual, document, studying from real things and video with content focusing on mangrove forest management, was able to learn, understand, and realize. They had attitude and skills to solve problems and they participated more in mangrove forest

management. This results in the success of mangrove forest management at Yeesarn sub-district. Since many people understand and know able the benefit of mangrove forest on community and themselves, they participate in mangrove forest management voluntarily (Amaraporn Sripurjarean, 2007).

From such reason, the researcher is interested in the model of environmental education outside of formal system. It has diverse scopes and methods. It also covers the targets extensively, aiming to adjust people's behavior for managing mangrove forest on eastern coast of Thailand, which is in crisis. Environmental education in the school cannot address such problem. In addition, the researcher thinks that only environmental education cannot be a factor that sufficiently increases mangrove forest management effectiveness. The best model of environmental study should consist of other factors that allow the people to participate in mangrove forest management at high level. This is for continuity and permanency of mangrove forest management, which is the origin of this research.

1.2 Objectives of Research

1) Find important factors that have influence on people's participation for sustainable mangrove forest management in eastern coast of Thailand.

2) Develop the model of participatory environmental education for sustainable mangrove forest management in eastern coast of Thailand.

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

1.3 Scope of Research

This study contains 3 scopes of the main point. The first scope is the study on important factor that have influence on people's participation for sustainable mangrove forest management on eastern part. The second scope is the development of participatory environmental education model for mangrove forest management on eastern part. The last scope is an evaluation on participatory environmental education model for sustainable mangrove forest management on eastern part.

Target population area heads of the families living in all villages, which are close to mangrove forest area, of eastern provinces of Thailand, aquatic animal breeders around coastal area, community leaders, politicians, representatives of private or independent institutes related to mangrove forest management in eastern provinces and representatives from government institutes related to mangrove forest management in eastern provinces.

1.4 Research Conceptual Framework

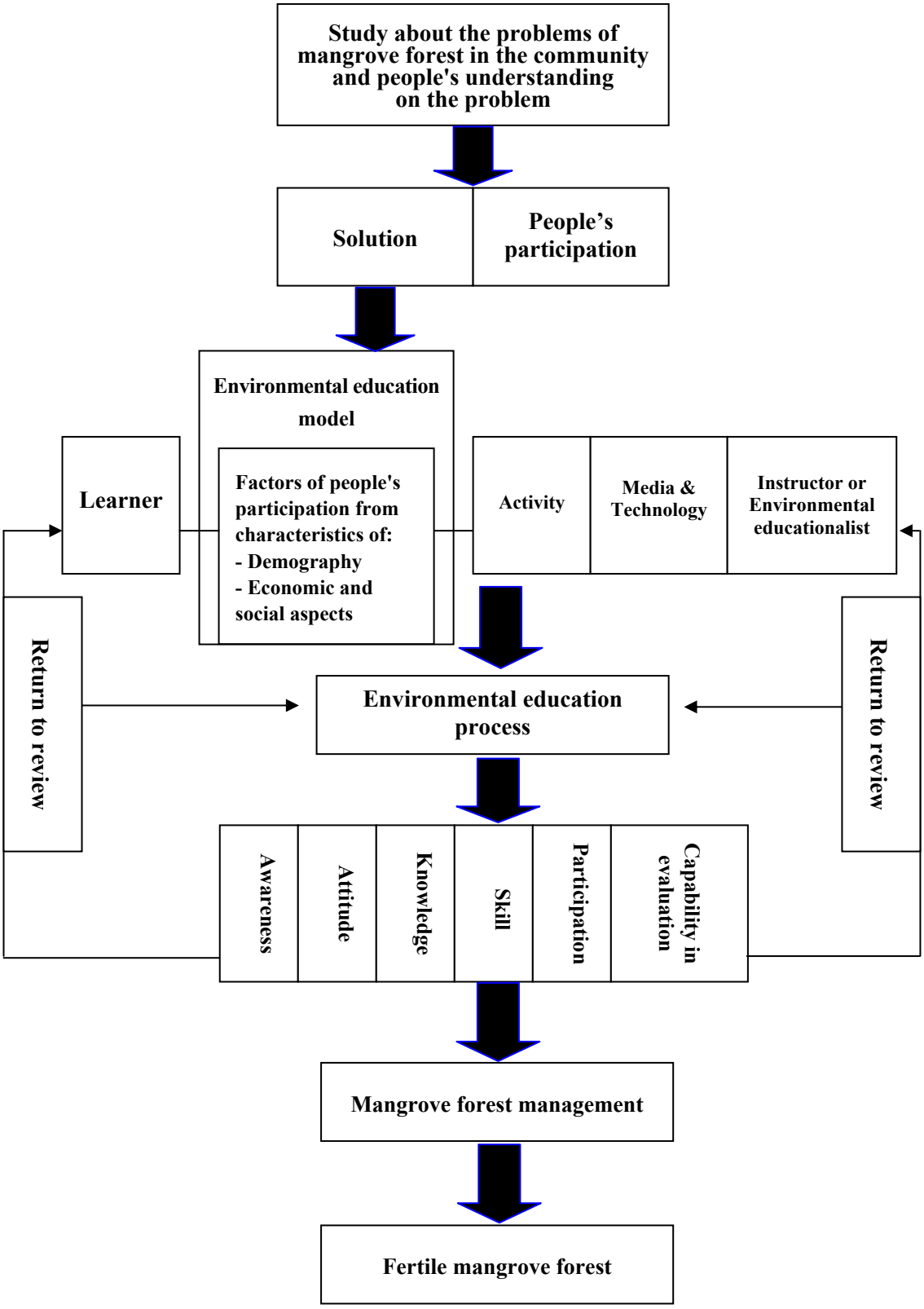

Figure 1.1 Research Conceptual Framework

This research is the development on environmental education model. Development process is as follows.

The first step: Study the problem of mangrove forest of communities in eastern provinces of Thailand and awareness of problem as well as people's awareness about such problem. This leads to knowledge and understanding in the cause of problem, severity of the problem, result of the problem on environmental condition and the people, solution, people's participatory level, and important factor influencing on people's participation.

The second step: is model development by using environmental education model, academic works, and information copied from primary or secondary document of project or institute successful in managing mangrove forest to develop appropriately for mangrove forest management on eastern coast. Apply new knowledge, process or procedure in the operation and implementation of environmental education model from many projects or many institutes to develop the most appropriate environmental model for mangrove forest management. Environmental educationalist and mangrove forest management expert including stakeholders from every sector should participate in the development of environmental education model. The model of environmental education created by cooperation from every side will consist of key factors that cause people to participate in mangrove forest management. The result is obtained from the first step of environmental study.

The third step is the test on environmental education model for mangrove forest management. It begins with randomizing for target area, which is the village with mangrove forest. After that, take environmental education model for mangrove forest management into environmental education process. Input factors of environmental education consist of target population, which are heads of the families or representatives, curriculum or environmental education model, activities associated with environmental education model, which is learning activity relying on media and technology for teaching, understanding, and environmental educationalist, which is the researcher doing environmental education activity. Before and after environmental education activity, evaluation on knowledge, knowledge about mangrove forest

management, awareness and sensitivity on mangrove forest problem, supportive attitude and feeling n mangrove forest management, skill in solving mangrove forest problem, evaluation ability on mangrove forest measures, and participatory level in solving mangrove forest problem. Target populations, who are head of the families or representatives, were sampled by using the questionnaire. The evaluation was conducted after environmental education activity. If newly developed environmental education is not successful, meaning not be able to increase knowledge, awareness, attitude, skill, evaluation ability and participation in mangrove forest management, new information and knowledge from the research will be applied to revise environmental education model. After that, arrange environmental education activity and evaluate again until the developed environmental education results in the increase of knowledge, understanding, awareness, attitude, problem solving skill, evaluation ability, and participation in mangrove forest management among target group.

1.5 Operational Definition

Environmental education model means set of environmental education activities regarding to mangrove forest management. They are combined systematically according to the theories. It has content and main point about mangrove forest management, objectives of the model, learner identification, instruction method, materials or media, and evaluation.

Demographic characteristic means age, educational level, knowledge and understanding about mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management of the people.

Economic and social characteristic means occupation, household income and the size of land possessed by the people.

Learners mean target people of environmental education regarding to mangrove forest management in eastern part of Thailand.

Activity means certain action performed by the learner in order to learn and understand about relationship between human and mangrove forest.

Media and technology mean art of disseminating knowledge about mangrove forest management by persons and materials to target population.

Environmental educationalist means the person that implants knowledge about environmental education regarding to mangrove forest management to target population.

Environmental education process means environmental education regarding to systematic management of mangrove forest. Five input factors are integrated into environmental education, including learner, environmental education model regarding to mangrove forest management, activity, media and technology, and instructor.

Knowledge means fact, rule, information and detail received and memorized by people living in the villages nearby mangrove forest area in eastern part. These are derived by study, research, observation and direct and indirect experiences.

Attitude means feeling and thought or people living in the villages nearby mangrove forest area in eastern part. This can be expressed positively or negatively.

Awareness means awareness of the people living in the villages nearby mangrove forest area in eastern part. This awareness is about the impact on well-being and the environment after the decrease of mangrove forests.

Problem-solving skill means ability of the people living in the villages nearby mangrove forest area in eastern part. This is about cognitive process in solving problem of mangrove forest management appropriately.

Evaluation ability means that people living in the villages nearby mangrove forest area in eastern part can use their knowledge, intellect, and wisdom to evaluate the impact on inappropriate mangrove forest management.

Mangrove forest management means having knowledge and understanding about conservation. Know how to use the existing mangrove forest resource appropriately. Conserve or reserve rare resources. Use mangrove forest resource wisely for maximum benefit in longest term. Prevent the loss in the use of mangrove forest resource.

Participation means that the people living in the villages nearby mangrove forest area in eastern part have opportunity to collectively study, plan, operate, verify, follow up, and evaluate the problem about mangrove forest management.

1.6 Expected Results

1.6.1 Obtain environmental education model for mangrove forest management that can be applied with eastern coast of Thailand efficiently and effectively.

1.6.2 People in the area nearby mangrove forest in eastern provinces have more knowledge, attitude, awareness, problem-solving skill, evaluation ability, and participation in mangrove forest management.

CHAPTER II
LITERATURE REVIEW

Literatures and concepts related to the study on the development of participatory environmental education model for mangrove forest management on the coast of Chanthaburi are as follows.

1. Concept about natural resource conservation and management
2. Government policy about mangrove forest conservation
3. Mangrove forest concept
4. Environmental education concept
5. Non-formal environmental education concept
6. Participation concept
7. Coastal mangrove forests of eastern provinces in Thailand and randomly sampled study area
8. Related researches

2.1 Concept about Natural Resource Conservation and Management

2.1.1 Meaning of conservation and management

The terms conservation and management were defined by many persons as follows.

Yongyut Ketsakorn (1999:24-27) defined the term management as conducting activities and operations as clearly determined by organization's policy in systematic and efficient manner. Management is commonly used in private business rather than in bureaucracy.

Somdet Srisaeng (2000:307-310) defined the term management as knowledge of management. This is because efficiency and effectiveness of management depend on completeness and quality of the factor.

Uthit Kutin (1993:47-56) defined the term "conservation" as management for smart utilization. It does not focus on maximum benefit but preserving for the next generations. Consumption amount is limited to the range that does not affect to natural resources. Non-destruction utilization must not cause impact on other natural resources in deformation or deterioration.

Kasem Chunkao (2004:80-83) defined the term "conservation" as the proper use of existing resources by conserving or preserving rare resources and preventing the loss in utilization of such resources.

Umnuay Korwanit (1987:17-24) defined the term "conservation" as utilizing while maintaining the original condition as much as possible.

Niwat Ruengpanit (1999:11-15) defined the term "conservation" as using the resources wisely in order to cause benefits to the public as much and long as possible. Resources must be minimally wasted and utilization on the resources must be spread thoroughly.

In conclusion, conservation means smart utilization management. It emphasizes on conserving for the next generation and utilization must be spread thoroughly. Destructive utilization must not exceed the limitation that affect to the nature. Non-destructive utilization must not deform or deteriorate other natural resources.

2.1.2 Conservation principle

Conservation principle consists of these following characteristics (Kasem Chankaew, 2004:83-85).

1) Sustainable utilization: Every kind of resources must be planned for sustainable utilization according to unique property of the resource. Select the technology appropriately for the resource and harvest. Take suitable duration for eliminating and treating wastes and toxins totally or left in harmless amount.

2) Restoration of deteriorated natural resources and artifacts: Resources are deteriorated when used. In appropriate use of technology or harvest require restoration so that such resource or the environment can recover. Then it can be used next time. It might take a long time for restoration, elimination, treatment or replacement.

3) Preserving rare items: Some resources and environments are rare. If inappropriate use is allowed to happen, they might become extinct. They must be preserved as breeders for production until their number is sufficient for utilization.

2.1.3 Conservation principle

Kasem Chunkao (2004:85-86) proposed conservation principle consisting of 8 methods as follows.

1) Utilization means many forms of usage, such as direct consumption, seeing, listening, touching, facilitating and securing. The use of these energies must be sustainable.

2) Retention means collecting and saving resources, which are possibly inadequate in certain times when crisis arises. They might be retained for utilization in appropriate amount.

3) Maintenance or repair means any proceeding on the resources, which are deficient or unable to function properly in order to recover. Human technology might be applied to help restore until it is usable.

4) Restoration means any proceeding that restores deteriorated resource or environment until they are usable. It sometimes takes a long time.

5) Development means improving things for better efficiency and production by using knowledge, technology and good planning.

6) Prevention means preventing the spread of the occurring incident and potential incident by using technology and good planning.

7) Preservation means maintaining without utilization in any means. The duration of preservation can be determined.

8) Zoning means classifying the area, group, or type according to resource property. The main cause is that implemented regulation or education is ineffective or to separate the area clearly for effective conservation, for example, national part,

wildlife sanctuary, pollution-control city. The measure must be established, otherwise, it will not be effective.

2.1.4 Mangrove forest management or conservation in Thailand

In 1961, Department of Forestry revised the regulation for mangrove forest logging and reorganized mangrove forest project in uniform manner. It determined logging cycle for 15 years. The forest of each project is divided into 15 plots. The system applied was Shelterwood with Minimum Girth Limit. Later on 4 January 1966, the cabinet determined to change mangrove forest logging policy from sub-procedure and monopoly authorization to long term concession for 15 year. Regarding to such government's policy, Department of Forestry surveyed to establish 310 logging projects according to the principle (there were concessionaires in 299 projects). It aimed at consistent production. The forest of each project was divided into 15 plots. Logging can be conducted on one plot each year according to Clear Felling in Alternate Strips System. The regulations and guidelines for mangrove forest logging are as follows.

- Align the strip at 45 degree to flood tide.
- Each strip is 40 meters width. Align across the plot by marking with color or cut as distinct space and set up the sign showing plot number of the strip.
- Cut the strips alternately throughout the plot.
- Cut all the plants, every size in the strip except seedlings of mangrove, Prong, Prasak, and bean with height below 15 centimeters.
- Collapsed woods and useless splinters will obstruct forestation if abandoned in the forest. Therefore, remove them from that area or chop them into pieces, so they will not be problem for forestation.

To manage mangrove forest concession according to the principle and to control the operation according to concession condition, Department of Forestry requested for budget to establish mangrove forest control unit to manage mangrove forest and control the operations of concessionaires. In 1968, it received the budget to establish 5 mangrove forest control units. Later in 1969-1971, it received budget to establish more 10 units each year. All 34 units were established corresponding to the

project. (Currently, there are 40 units.) Each unit controls mangrove forest in about 10 projects (Sonjai Hawanon and Jirasak Chukwamdee, 2000:149-150).

The main objective in establishing mangrove forest control project is to manage mangrove forest according to bureaucratic purpose in order to improve mangrove forest so that it will be beneficial and productive maximally and continuously. Department of Forestry researched for appropriate method to apply with mangrove forest. It considered that Clear Felling in Alternate Strip System would be the most effective. That means:

- Able to control logging conveniently
- Make the forest more abundant
- Able to increase production capacity of the forest
- Able to eliminate useless plants and keep valuable plants
- Forestation helps reproduction of the plants considerably
- Newly grown plants have consistent age throughout the plot. This is convenient and beneficial for future management

In the past, 90% of mangrove woods were used as charcoal. Mangrove charcoal is the best fuel. Thailand produced mangrove charcoal and exported to foreign countries, namely Malaysia, Singapore, Hong Kong, and some countries in Middle East.

About forestation of mangrove forest according to 10^{th} condition of ministry's resolution on 4 January 1966, the concessionaire must reforest to make it fertile and prepared for consistent production. They concessionaire has to pay for this cost personally. Department of Forestry determined the criterion for concessionaire to reforest in all plots that have been deforested. In case that deforest plot has dense young plants, reforest in other deteriorated plots instead.

In 1972, project unit was renamed as forest management unit. Mangrove management division was established to take care of mangrove forest control units.

In 1975, mangrove control units were transferred to be under local forestry department. They were established as mangrove management division. In central part, mangrove forest management division was still taking responsibility.

In 1979, mangrove forest management division was transferred to be under central forestry management department and southern forestry management department corresponding to the region.

In 1982, Department of Forestry established mangrove research center in Ranong as a place for domestic and foreign researchers to conduct research on mangrove forest.

In 1983, the ministry approved the principle of mangrove forest logging on 9th August 1983 by allowing continuation of 15 years concession. The new concession was revised appropriately regarding to logging and reforestation methods.

In 1987, the ministry approved on 15th December 1987 that Department of Forestry would separate mangrove forest into 3 zones as follows.

- Conservation zone
- Economic A zone
- Economic B zone

In 1989, mangrove management units were reestablished under forestry management division.

In 1991, the ministry approved on 4th June 1991 regarding to urgent measure in managing coastal resources including mangrove forest and coral reef. Department of Forestry created mangrove forest conservation project. It aimed to protect and restore mangrove forest throughout the country and manage mangrove forest utilization corresponding to natural resource conservation. The duration was determined at 5 years (1992-1996). There was establishment of 4 mangrove seed production centers.

In 1992, Department of Forestry arranged 3-years manpower plan for mangrove forest management department, forest management division into mangrove forest research team and mangrove forest management department. At the same time, Department of Forestry restructured and revoked forestry management division. Therefore, mangrove forest research team was transferred to be under Office of Forestry Academic Affairs and mangrove forest management department was transferred to be under Department of Natural Resources.

In 1993, forestry management division was revoked. Department of Forestry divided institutes under Office of Forestry Academic Affairs in to parts. Each part consists of different groups. Mangrove forest research group was under forestry economic research and development, Office of Forestry Academic Affairs (Department of Forestry, 2007).

Mangrove forest management has major activities in reforesting mangrove forest and conserving and protecting mangrove forest in order to compensate the forest extremely destroyed by prawn farms. Mangrove forestation can be classified by practitioners as follows.

2.1.5 Mangrove forestation by government budget

Mangrove forestation in this project is the experiment of growing mangroves in small space. There was no project to grow every year continuously. Mangrove forest was grown by using government budget from 1939 to 1991 in Chanthaburi, Nakhonsithammarat, Trang, Satun, Pattani, Krabi, and Chumphon, totally about 56,660 rai.

2.1.6 Mangrove forestation corresponding to ministry resolution

On 4th June 1991, the ministry determined the target of mangrove forestation at 250,000 rai in deteriorated forest area and newly-arisen muddy area with forestation potential. Four mangrove seed production centers were part in contribution. In the result of operation until 1994, Department of Forestry has grown mangrove forest at 49,987.5 rai. The remaining area that must be completed according to the target is 200,012.5 rai.

2.1.7 Mangrove forestation according to mangrove forest logging concession

In the condition of the first logging concession (since 1968), the concessionaire had to reforest for one time of the royalty only. Thus, the forests were not reforested completely. Therefore, the new condition in the second logging

concession has been revised appropriately. It determines that concessionaire must reforest mangrove forest completely in all strips, where woods were cut. In addition, the concessionaire must reforest in concession area according to the method specified by Department of Forestry with the cost 3 times of the royalty. The concessionaire must also dig the grass to help the growth of newly-grown mangrove plants.

2.1.8 Mangrove forestation by private sector

Mangrove forestation is mostly the occupation in possessed lands, which are inherited.

2.1.9 Mangrove forestation according to mangrove forestation project for honoring his majesty

In permanent forestation project for honoring the king in the occasion of the 50th year of enthronement, Department of Forestry, as an institute responsible for forestation, was assigned to allocate the target land for forestation. In the part of mangrove forest, Department of Forestry allocated 31,754 rai of target land, consisting of 57 places in 12 provinces.

2.1.10 Mangrove forest conservation and protection

Department of Forestry determined conservation and prevention measure. It conducted these following operations.

- Created the signs indicating 3 mangrove forest zones, namely conservation zone, economic A zone, and economic B zone.
- Improved effectiveness of existing 34 mangrove forest management units and established 6 more mangrove forest management units in order to achieve the goal of the institute.
- Department of Forestry cooperated with the navy, Department of Fisheries, and relevant institutes to protect and conserve mangrove forest area.

- Established 4 mangrove seed production centers to grow young plants and produce mangrove seeds. The objective was to support mangrove forest restoration and distribute young plants to the public.

- Publicize and run the campaign for conservation and prevention of mangrove forest by creating brochures, posters, and documents. Arrange the exhibition and convince the people to help restore mangrove forest in important days (Department of Forestry, 2007).

2.1.11 Direction of future mangrove forest management

From the current situation of mangrove forest, it can be seen that previous mangrove forest management must be solved and improved. The first reason is that mangrove forest area has decreased more than half of what it was in the past. If the situation of mangrove forest is still carrying on as it is in the present, it is possible that mangrove forest area will be converted into other businesses, particularly prawn farm. Secondly, the condition of remaining mangrove forests is not abundant like it was in the past, regarding to primary production of ecology in the form of biomass and wood production for fuel or the amount of aquatic animals around mangrove forest ecology. Finally, deterioration of coastal ecology becomes more severe and causes impact to economic and social condition of rural community extremely. Therefore, future mangrove forest management must be changed in both management target and different management method. This is to be correspond with the need and acceptable for the people, who possesses the resources. The trend of future mangrove forest management can be concluded as follows (Sonjai Hawanon, Jirasak Chukwandee, 2000:151).

2.1.12 Purpose of management

Future mangrove forest management must aim at universal benefit on the community in both direct and indirect ways, including prevention of coastal erosion, preservation of proper properties of soil, water, toxic substance absorption, and carbon dioxide-oxygen exchange in the atmosphere.

2.1.13 Management

The impact on economic, social and environmental conditions caused by deterioration of the resources spreads to nearby ecology. Management must emphasize on participation of many sides, especially local communities and private sectors. They should cooperate with government sector in:

- Create consciousness in caring the resources together
- Protect, maintain, and guard the resources
- Grow and restore deteriorated forest
- Create and utilize the resources wisely
- Understand the natural of ecology and the impact from destroying the form of mangrove forest. In the future, the area might be classified by management goal as follows.

Conservation and natural education zone: The public service includes mangrove forest research center, mangrove forest research and conservation station, and mangrove forest management units in provinces with mangrove forests.

Seed production zone for reforestation: The public service includes mangrove seed production center and mangrove forest management units in many provinces.

Forest area that must be restored includes deteriorated forest and muddy coastal area with potential in mangrove forestation.

Community utilization forest area: Subdistrict administration organization, by advice of forestry officer, is public service regarding to management determination on each area as appropriate (Sonjai Hawanon, Jirasak Chukwamdee, 2000:152).

2.1.14 Sustainable mangrove forest management

Jira Jintanukul (1997) provided the guideline necessary for the operation for maintaining mangrove forest area as expected. It is beneficial according to sustainable development.

1. Push on development and support collaboration of local people in conservation and development of mangrove forest by teaching, which will create

consciousness and the need in conserving and restoring mangrove forest resource. The government should support regarding to the right and security as well as incentive these people should receive from mangrove forest protection and restoration including other necessary supports. This is another guideline to support people's potential in managing mangrove community forest further.

2. Revise the law and regulation regarding to utilization of mangrove forest area corresponding to situation of invasion, destruction, and possession of mangrove forest area. This is to eliminate the problem of title deed in mangrove forest.

3. Survey mangrove forest area thoroughly. Use the information to manage the forest as conserved mangrove forest and community forest as appropriate under effective management plan.

4. Encourage and support continuous mangrove forest forestation on government and private lands. This is to maintain fertility of mangrove forest and biological diversity.

5. Improve mangrove forest conservation and protection. Increase cooperation and coordination between responsible institutes. Develop and improve the role of the officers in forest protection unit and mangrove forest management unit as mangrove forest supporter and developer.

6. Improve the structure of mangrove forest management system of Department of Forestry to be unity.

7. Encourage international collaboration and international organizations in conserving natural resources and environment.

2.1.15 Mangrove forest conservation for future well-being

Most people settled on the coast of the country, where coast length is over 2,600 kilometers, must depend on mangrove forest directly and indirectly. Therefore, the decrease and deterioration of remaining mangrove forest affect to living quality of these people directly. In addition, it also affects to coastal ecology and the country's fishery resources entirely. Thus, it is necessary to maintain and restore the remaining mangrove forest while afforesting more mangrove forests. Traditionally, muddy coast should have mangrove forest in order to protect the coast. This should occupy the area

at least 300 meters from the sea. Along the bank of canal in brackish water zone, mangrove forest should occupy at least 40 meters. This is to protect and maintain coastal ecology. This is considered depending on tide and landscape. It prevents collapse and beneficial for sustainable fishery for the people living near the coast (Department of Forestry, 2007).

In conclusion, conservation and management of natural resources means using natural resources wisely. Emphasize on conserving for the next generation. Spread benefits of utilization thoroughly. For consumable utilization, the limit must be set so that it will not change natural resources irrecoverably. Non-consumable utilization must no cause the impact on other natural resources or the environment to deform or deteriorate.

2.2 Government policies regarding to mangrove forest conservation

2.2.1 Policies about mangrove forest conservation

From the importance of mangrove forest resource and the impact on the society due to the decrease of mangrove forest area, the government realized the importance in conserving mangrove forest resource. Therefore, it determined the policies and measures as follows (Boonchana Klankhamsorn, 1988:13-46).

1. In resolution of the ministry on 15th December 1987, utilization of mangrove forest area was classified into 3 zones as proposed by Ministry of Agriculture and Cooperatives, including:

1.1 Conservation zone means forbidden mangrove forest area. It cannot be transformed for any use except leaving it naturally in order to maintain the environment and ecology.

1.2 Economic A zone means mangrove forest area allowed to be used for forestry business for sustainable products according to the principle.

1.3 Economic B zone means mangrove forest area allowed for land utilization and developments. However, advantages and disadvantages on the environment must be considered.

2. In resolution of the ministry on 4th June 1991, the principle of urgent coastal resources management regarding to mangrove and coral reef was approved. Department of Forestry established development project on conserved mangrove forest zone. It aimed to protect and restore mangrove forest across the country completely and manage utilization on mangrove forest area corresponding to natural resources conservation.

3. In resolution of the ministry on 23rd July, the main points included:

3.1 Assigned National Board of Forestry to find strict measure that is able to stop destruction on the country's mangrove forests.

3.2 Ceased utilization on mangrove forest absolutely. Ministry of Interior was assigned to proceed in order to stop invasion in mangrove forest area.

3.3 Assigned Bank of Thailand to be in charge of providing loan for commercial banks. It would ask for cooperation from commercial banks to stop loaning to projects that might invade, destroy or change the condition of mangrove forest area.

4. In resolution of the ministry on 16th July 1996, urgent and long-term measures regarding to protection and restoration of mangrove forest were determined. They were considered the main policy in every activity about mangrove forest.

5. In resolution of the ministry on 19th November 1996, the main points included:

5.1 Revoked mangrove forest concession across the country and mangrove forest concession would no longer available.

5.2 Approved the measure and guideline of mangrove forest conservation and restoration plan according to resolution of the ministry on 16th July 1996.

6. In resolution of the ministry on 30th June 1998, the principle, measure, and guideline for solving problems on forest land proposed by National Board of Forestry were approved. Department of Forestry was assigned to consider on the ministry's notices as follows.

6.1 About the conflict with people, one cause is due to the lack of clear forest line. Department of Forestry should arrange clear forest line for convenience in proving and prevent involuntary invasion.

6.2 Some areas are under many laws and many responsible institutes. Department of Forestry should coordinate with relevant institutes to examine and classify clearly.

6.3 In conserved zones possessed by civilians, Department of Forestry should consider carefully on providing infrastructures or facilities as appropriate.

2.2.2 Policies of Ministry of Natural Resources and Environment

Ministry of Natural Resources and Environment determined policies, strategies, and tactics related to natural resources in 2003 as follows (Department of National Park, Wildlife, and Plant Species, 2003).

1. Natural resources policies

1.1 Evaluate status and potential of every kind of resources and biodiversity.

1.2 Preserve, conserve, develop, restore and maintain fertile condition of natural resources. Manage utilization to meet the need according to the potential for sustainable benefits. Support and operate on projects in royal idea.

1.3 Create added value in the aspect of economy, social, and environment of all kind of natural resources for worthwhile utilization.

1.4 Create rules, regulations, and system for accessing natural resources of local communities and every group of people effectively. Share benefits fairly. Determine suggestion, guideline, and measure for utilization of all kinds of natural resources permanently corresponding to the situation based on information from research and development.

2. Management policies

2.1 Manage and develop natural resources and the environment in holistic way. Adhere to land management, participation and decentralization.

2.2 Educate all levels of the people and elevate capability of all organizations continuously.

2.3 Develop personnel in the area of knowledge and skills to be effective corresponding to the role and mission of the ministry.

2.4 Develop the system and management standard and database implementation by using information technology and effective communication, which is able to connect with the main information system of the country.

2.5 Encourage research and development to support the determination of policies, plans and operations at every level.

2.6 Run the campaign and create awareness of all people. Establish participatory network for serious and continuous operation.

2.7 Follow up and address the complaints of the people about natural and environmental resources. Develop devices and mechanisms in managing natural and environmental resources to become more effective.

2.8 Motivate by using economic, social and legal measures.

2.9 Develop the mechanism to reduce conflict in using natural resources and solving environmental problems. Support marketing mechanism for the social to balance demand and supply in natural and environmental resources management.

2.10 Improve, revise and propose new law to be a tool for operation. Enforce relevant law corresponding to the situation.

2.11 Increase the role regarding to natural and environment resources on global stage in order to develop cooperation and protect the interests of the people and the country.

2.12 Follow up, examine and evaluate the results with clear performance indicator.

3. Strategies and tactics

3.1 Strategy 1: Preserve, protect, conserve, utilize, and restore natural resources and biodiversity with people's participation.

3.2 Strategy 2: Direct, control and restore the environment. Reduce pollution.

2.2.3 The Act of Subdistrict Council and Subdistrict Administrative Organization 1994

The Act of Subdistrict Council and Subdistrict Administrative Organization 1994 regulated authority and function of Subdistrict Council and Subdistrict Administrative Organization regarding to natural and environmental resources management as follows (Department of Local Administration, 1996).

Section 23 regulated authority and function of Subdistrict Council as "under the law, Subdistrict Council conducts these following activities within subdistict (4) Protect, control, and maintain natural and environmental resources…."

Section 67 regulated authority and function of Subdistrict Administrative Organization as "under the law, Subdistrict Administrative Organization is responsible for these following duties within Subdistrict Administrative Organization zone (7) Protect, control and maintain natural and environmental resources…"

In conclusion, government policies regarding to mangrove forest conservation or management have been performing. They aim to preserve the existing mangrove forests, restore mangrove forest, protect forest area by using legislation, and support additional forestation. In the present, people's participation is being supported in conserving or managing mangrove forest.

2.3 Mangrove Forest Concept

2.3.1 Meaning and characteristic of mangrove forest

Sonjai Hawanon and Jirasak Chukwamdee (2000:159) defined the term "mangrove forest" as botanical society grown around on the area submerged under normal sea level. It is commonly found around estuary. The plants do not shed leaves in the same season.

Boonchana Klankhamsorn (1991:13-46) defined the term "mangrove forest" as botanical society classified in non-deciduous type. It mostly consists of evergreen plant species. They shed leaves gradually. The trees are dense. Each species has different types of roots.

The Royal Institute (1999:690-691) defined the term “mangrove forest” as coastal forest in tropical zone, especially around the estuary. The plants have roots grown out of the trunks and branches to support the trunk on muddy coast. Plant species consist of Rhizophora mucronata Pior., Rhizophora apiculata BL., Ceriops tagal, Xylocarpus granatum Koen., Sonneratia spp., Avicennia officinalis Linn., Avicennia alba, etc. Ground plant species consist of Acrostichum aureum Linn., Acanthus spp., Nypa fruticans Wurmb. and other plant species.

Sanit Aksornkaew (1998:2-3) defined the term “mangrove forest” as botanical society grown around the estuary or bay submerged under the sea during highest flood tide. Due to different environmental factors of mangrove forest, the plants grown in mangrove forest have adapted to the condition of the area. They tolerate to drought. They are able to grown on the mud by developing appropriate root system, such as supporting root. Plant species in mangrove forest are grown in different zones depending on control factors, including flood tide, soil type, amount of sault and light. Plant species in Thailand’s mangrove forest can be classified into these following zones.

1) Zone 1: This zone is close to the river. It is the area of mangrove, namely Rhizophora mucronata Poir. and Rhizophora apiculata Bl., which is more dense. In addition, there are Nypa fruticans Wurm. grown densely in some places near the coast.

2) Zone 2: This zone is next to mangrove zone. It is the area of Aegiceras cornicalatum. and Prasak.

3) Zone 3: This zone is deep form zone 2. Xylocarpus granatum Koen. Species are found densely. The soil in this area is quite hard. However, some areas in this zone, which are submerged under flood tide, are the area of Prong and Lumnitzera littorea Voigh. However, both species are sometimes found with Xylocarpus granatum Koen.

4) Zone 4: This zone is hard muddy area under sea level during flood tide. It is the area of Samed trees, which are dense. It connects between mangrove forest and forest land.

Due (1962:26) defined the term “mangrove forest” as (1) Botanical society consisting of various evergreen plant species with similar biological characteristics and environmental needs (2) Botanical society growing around the estuary of tropical

region. It mainly consists of Rhizophora family plants mixed up with some other species.

Somkid Siripatanadilok (1992:61-78) identified basic environmental factors that cause mangrove forest. (1) The temperature is tropical region-like. That means the average temperature in the coldest month must not lower than 20 Celsius. (2) The soil must be fine and soft mud rich in organic substances. (3) Submerged under brackish water, not salty sea water. (4) No strong tide. So, it is commonly found on the coast or the estuary, where the tide is not strong. (5) Obvious flood tide and ebb tide with long cycle in each day.

In conclusion, mangrove forest means the forest located on the coast in tropical region, especially around the estuary. There are plants with roots growing out from trunks and branches to support the trunk. These plants grow along muddy coast. Each plant species in mangrove forest grows in different zones depending on control factors, namely inundation of sea water, soil type, amount of salt and light. It mainly consists of Rhizophora family plants mixed up with some other plants.

2.3.2 The nature of mangrove forest

Mangrove forest is the habitat of diverse creatures, including plants and animals with different amount and ratio in each place due to different mangrove forest environment. In Thailand, the study suggests that there are 45 families, 53 genus, and 74 species of plants. Among these, there are 45 species of the trees. Plant species notable in the social include Rhizophora mucronata Poir., Rhizophora apiculata Bl., Sonneratia caseolaris (L.) Engler, Sonneratia alba J.E Smith, Avicennia officnalis Linn., Xylocarpus granatum Koen. Ground plant species commonly found include Acanthus spp., Nypa fruticans Wurm., Phonix paludosa Roxb., epiphytes. There are 18 species according to the survey . About the animals living in mangrove forest, about 191 species of invertebrates and 144 species of vertebrates were found in the survey. These consist of 70 families of fishes, 15 species of prawns, and 26 species of clams around mangrove forest. Other animals in mangrove forest, such as birds, include migratory and local birds. The survey found 88 species (Sanit Aksornkaew, 1998: 57-66).

2.3.3 Importance of mangrove forest

Sonjai Hawanon and Jirasak Chukwamdee (2000:127) mentioned that mangrove forest connects between the land and the sea (Ecotone) in tropical region and subtropical region. It has high biodiversity and valuable. At the same time, it functions as a fortress protecting and maintaining environmental balance. It is also the origin of food chain of humanity.

Boonream Chommek (1996:1-75) stated that mangrove forest is important and considerably valuable for humanity in the area of education, economy, social, fishery, forestry as well as environmental conservation. Mangrove forest is food chain of sea animals living around the coast and in the sea. It is the source of food, habitat, breeding and nurturing place of aquatic animals. It is the habitat of various economic animals. Moreover, mangrove forest also helps protect natural disasters.

Yod Kirirat (1997:5-13) offered a viewpoint that mangrove forest is an ecology consisting of diverse plants and animals living together in muddy environment swamped by salty water and brackish water. Mangrove forest not only crucially important for the living of the people living nearby mangrove forest, it is also natural food storage that feed human living. It is also the habitat of wildlife. It prevents natural disasters. It filters wastes and toxins. It is diverse ecology. It helps maintain natural and environmental balance.

Sanit Aksornkaew (1998:11-27) stated that mangrove forest is highly valuable ecology and important for humans in many aspects as follows.

1) Utilize the wood: The wood obtained from mangrove forest not only beneficial for making charcoal, it can be used as firewood, foundation pile, supportive wood, and furniture. Moreover, some developers used it as material in extracting tanning, which is very important in bleaching and dying.

2) Mangrove forest prevent wind and tide. It is able to restore itself when damaged by the storm. Mangrove forest helps decrease intensity of the storm until it is not harmful to human and other ecological system inland.

3) It entraps dregs, wastes, and toxins from the land so that they will not flow into the sea.

4) It is piled up with sand flowing along with the river. Mangrove forest line decelerates the tide. It precipitates soil, leading to expansion of the land.

5) Mangrove forest is spawning place, food source, and growing place of mangy economic animals, such as prawn and fishes. Furthermore, it provides shade and shelter for small creatures, which are foods of aquatic animals.

6) Mangrove facilitate breeding of economic aquatic animals, such as prawn and crab.

7) Mangrove forest is the source of living of people living around the coast, who support their lives by small coastal fishery, such as bench god for fishing equipment, bark for dying fishnet, and atop for food and roofing.

8) Mangrove forest is tourist attraction and recreation place, such as national part.

In conclusion, mangrove forest is important for humans in both direct and indirect ways. The most obvious direct benefits are using wood and food from mangrove forest. About indirect benefits, mangrove forest prevents wind and tide form the sea. It filters wastes that will flow into the sea. It is also an important source of food production.

2.3.4 Origin of mangrove forest

Thongchai Jarupaphat and Jirawan Jarupaphat (1997:1-8) stated that mangrove forest generally grows along the coast, estuary, lake, bay, island, and islet inundated by seawater in tropical regions, such as American tropical region, African tropical region, and Asian tropical region. Particularly Asian tropical region, it is found that it has the most mangrove forest area in the world. There are approximately 133.4 million rai of mangrove forest area. About 52.56 million rai are located in Asia. About 39.61 million rai are located in America. About 21.26 million rai are located in Africa. Abundant mangrove forests in the world are located along the equator in Asia, such as Indonesia, Malaysia, Papua, Bangladesh, India, and Thailand. The areas far from the equator toward the north and the south have some mangrove forests, such as the north to the south of Japan, Quaba bay in Red Sea, and Florida State in the United States. About the south, there are mangrove forest up to the north of New Zealand and

the south of Brazil. In conclusion, the world has mangrove forests in the area between latitude 27 degree 30 minute north and south only.

2.3.5 Environmental factors of mangrove forest

Environmental factors that influence mangrove forest consist of 8 types as follows (Sanit Aksornkaew, 1998:33-53).

1. Coastal geography: Mangrove forests usually grow around muddy and broad coast inundated by water. Mangrove forest in Thailand must originate on sandy soil along the coast, river, canal, lake, and island usually inundated by water. The appropriate geography is around the bay without strong tide and wind. There must be big watercourse flowing into the sea and little sloping bed. Geographic characteristics are important factors for the structure, type, and the spread of plant and animal species.

2. Climate, including light, rain, temperature and wind, is very important for mangrove forest ecology. Light intensity should be in the range of 3,000 – 3,800 kilo calorie per square meter. Rainfall should be about 1,500 – 3,000 millimeters for 8 – 10 months per year. If the temperature is not appropriate for the area, the plants will less likely to put fourth leaves. Wind has an influence on tide speed around the coast, water evaporation and reproduction.

3. The soil around mangrove forest originated by deposition of sediment from estuary. Appropriate soil should have pH from 6.2 to 6.6 respectively. The soil under mangrove plants should have humidity from 67 – 246 percent by weight. The soil under copse plants should have humidity below 45 – 196 percent by weight approximately. In addition, characteristic of coastal soil relates to type, amount and the spread of wildlife in mangrove forest.

4. Flood tide and ebb tide around the coast is an important factor for classifying the zone of plant species and aquatic animals in mangrove forest. During flood tide, it influences on the change of saltiness around mangrove forest. Saltiness will increase and decrease corresponding to the tide. When ebb tide occurs twice a day, duration of salty water flood in each area differentiate plant species.

5. Saltiness of soil water is an important factor in the growth. Classification depends on plants species in mangrove forest. Generally, mangrove

forest grows well in the place with brackish water with saltiness range from 10 – 30 percent. Sonneratia cascolaris (L) Engler, Sonneratia ovata Back. and Aegiceras cornicalatum are obvious in the area with sea saltiness at 10 – 30 percent and inundated under the water about 10 – 19 days per month. Mangrove trees mostly grow here.

6. Wind and tide are important for coastal erosion. They cause precipitation around the coast. The tide has influence on the growth of young mangrove plants because the wave will sweep the plants to mangrove forest area. The tide influences on the change of structure and activities in mangrove forest ecology directly and indirectly.

7. The amount of soluble oxygen in the water determines type and growth rate of plants and aquatic animals around mangrove forest. The value of oxygen dissolved in water ranges from 3.8 – 7.3 millimeters per liter. It varies according time, daytime and nighttime, season, and fertility of creatures in mangrove forest.

8. Nutrient consists of 2 types, namely organic and inorganic. They are extremely necessary for living in mangrove forest. All nutrients are normally sufficient, except for nitrogen and phosphorus, which are low in amount. Thus, they limit the growth of plants and aquatic animals in mangrove forest.

2.3.6 Characteristics of mangrove forest occurrence

Mangrove forest originates on muddy land along the coast, river, canal, island, lake, and bay frequently inundated by sea water, no strong tide. Plant species in each place vary depending on climate, geography, and environment. Generally, the characteristics are as follows (Thongchai Jarupaphat, 1998).

1. Plant species Avicennia spp. firstly originate on clay. Then Bruguiera cylindrical BL. will replace Avicennia spp. It particularly begins around the estuary, where fertile alluvial soils precipitate on the upper layer.

2. Sonneratia cascolaris (L) Engler, Sonneratia ovata Back firstly originate on the clay around the estuary inundated by water level nearly all the time. Later, Rhizophora mucronata Poir. will replace if the soil does not pile up too fast. If the soil in such area has good ventilation and high plant residues, Rhizophora apiculata BL. will grow well. Mangrove species are able to grow on furthest inland, where sea water always overflows.

3. On the area, where various plant species are able to grow as mentioned above, when geographical condition has changed because the tide carries dregs to pile up to make the land higher, sea water can no longer overflow there. Finally, Rhizophora, Brugiuera spp. and Acrostichum aureum Linn. grow densely. The spread of mangrove plants is not good enough, so mangroves are very few in this area.

4. When the land becomes higher to certain level, sea water overflow occasionally. This area become the border (ecotone) connecting between mangrove forest and land forest, where Melaleuca leucadendron Linn., Xylocarpus granatum Koen., Xylocarpus gangeticus Parkins., Lumnitzera littorea Voigh., Intsia bijuga Ktze., and Cnetis palala Merr. grow.

2.3.7 Activities that cause problems and affect to mangrove forest area

Sonjai Hawanon and Jirasak Chukwamdee (2000:138-142) stated that activities that affect to mangrove forest consist of the expansion of communities, which construct building in mangrove forest area, agriculture, industrial structures and public utility, aquatic animal breeding, mining, building dam and dredging watercourse. These activities are carried on in mangrove forest area.

Kasem Chunkao (1986; cited in Samran Rakchart, 2005:32) stated that the causes of problem and impact on mangrove forest were construction of factories. They mostly were fishery-related industry. Construction of factories in mangrove forest permanently destroys mangrove forest condition. It also deteriorates neighboring mangrove forests. In the case that the factory releases waste water into mangrove forest without proper treatment, it might damages creatures in mangrove forest ecology system.

Sanit Aksornkaew (1998:191-200) stated that salt farm has the vast impact on the change of mangrove forest area in Samut Songkhram, Samut Sakhon, and Samut Prakan. Mining in mangrove forest removes the soil out of the area. Dregs of the mine will pile up on the ground and plant roots. Moreover, dregs or waste water released from the mine into mangrove forest destroy nearby mangrove forest ecology system. Mining is mostly found in Ranng, Phangnga, and Phuket.

Thatsanee Chanthadisai (1990:1-13) stated about activities that have the impact on mangrove forest and the environment. This includes: 1) Port harbor construction, extension of harbor construction in mangrove forest near the coast in the future, such as Krabi, Phangnga, Nakhonsithammarat. 2) Dam construction and dredging have affect to the change of watercourse. It causes movement and precipitation of sand in other places, which changes natural barrier.

Sitthiphan Sirirattanachai (1995:6-9) stated that Thailand's mangrove forest was invaded and used for other purposes more than 50%. During 1961 – 1996, people have always been invading and occupying mangrove forest increasingly. Although the government issued policies and measures to protect and maintain the country's mangrove forests, there were numerous forms of invasions to use mangrove forest area, which deteriorated mangrove forest resources.

Department of Environmental Quality Promotion (1994) stated about activities that affected to mangrove forest and the environment including: 1) Cutting too many woods exceeding forest production capability. At present, a lot of woods are needed for building houses and furniture. Therefore, there are more illegal loggings that exceed forest production capability. This is the cause that many mangrove forests are deteriorated. 2) Agriculture: This means agriculture in mangrove forest area or neighboring area. Generally, soil, water, and other related factors of mangrove forest are not appropriate for agricultural development. 3) Urbanization: Community development in mangrove forest area includes building houses, official places, academic institutes, customhouse, and development in the form of fishery cooperatives and coastal breeding as well as certain public assistances. The impact of the community not only occurs in proceeding duration, it also has long-term impact due to deforestation for community expansion. This removes barrier, which prevents tide and wind. Thus, dregs and toxins are released into the water. 4) Road construction: Cutting roads through mangrove forest destroys mangrove forest condition permanently.

Boonream Chommek (1996; cited in Samran Rakchart, 2005:34) stated that most changes on mangrove forest utilization for aquatic animal breeding were for prawn farm, which spread over many provinces along the coast. Prawn farms are mostly found along the coast of the gulf of Thailand, including Samut Songkhram, Rayong, Chanthaburi, Chumphon, Suratthani, and Nakhonsithammarat. Prawn farm

needs fertile mangrove forest area because it will reduce the cost of aquatic animal species and food required to supplement with abundant natural foods. Particularly in Chanthaburi, mangrove forest area was widely destroyed in order to expand prawn farm business.

2.3.8 Mangrove forest ecology

Mangrove forest ecology consists of 2 important compositions, namely ecosystem structure and ecosystem function as follows (Sanit Aksornkaew, 1998: 111-124).

1. Ecosystem structure

1.1 Producers are organic substance makers by photosynthesis, including phytoplankton, algae, and various plant species in mangrove forest.

1.2 Consumers in mangrove forest can be classified in large groups as follows.

1.2.1 Organic substance consumers include small animals living on the ground, clams, and some fish species.

1.2.2 Herbivores consume plants directly, such as planktons, crabs, earthworms, and some fish species.

1.2.3 Carnivores include lower carnivores, namely prawns, crabs, small fishes, some kingfishers, and top carnivores, namely big fishes, birds, reptiles, mammals and humans.

1.2.4 Omnivores include some fishes. Mostly this group of animals consumes both plants and animals.

1.3 Decomposers include bacteria, fungus, crabs and clams.

2. Functions or activities of ecosystem are about food chain and energy transfer. It can be classified in to 2 major types. The first type is food chain starting from green plants to other animals on the upper levels. The second type is food chain starting from organic substances to other animals on the upper levels.

In conclusion, mangrove forests are located on the coast in tropical regions. They consist of diverse plant species with Rhizophora as important plant. Mangrove forest is important for humans directly and indirectly. They are food sources, barriers preventing wind and tide, and important breeding sites. However, at the same time, the advancement of technologies, economy, and social as well as the increase of population have decreased mangrove forest area. The result from the loss of mangrove forest area directly caused undesirable impact on the people.

2.4 Environmental Education Concept

2.4.1 Meaning of Environmental Education

Winai Weerawattananon (1987:2) defined the term environmental education as the study on natural and artificial environment as well as objective and subjective factors that change environmental condition and affect to humans. It aims to create good behavior or value for the social in improving and maintain the environment.

Kasem Chunkao (1993:71) defined the term environmental education as systematic educational process by applying academic technologies as media to teach all people about environment in order to maintain good environmental condition.

Steidle (1971 : 21) was cited in Kasem Chunkao and Praphan Koaysomboon (1982). He defined the term environmental education as educational process studying about relationship between humans and surroundings, including natural and artificial things as well as relationship between population, pollution, resources, conservation, transportation, technologies, city plan and the environment.

Labinowich (1971:32) was cited in Kasem Chunkao and Praphan Koaysomboon (1982). He defined the term environmental education as instructing people about surrounding environment and environmental problems that affect to the people, so that the people would participate in solving environmental problems.

Bowman (1974 : 1) was cited in Kasem Chunkao and Praphan Koaysomboon (1982). He defined the term environmental education as the process that develops the public to be aware about physical and social environment surrounding humans. It makes the people to realize on the impacts and solve those problems. Corresponding to the concept of Lucko (1982 : 8) cited in Kasem Chunkao and Praphan Koaysomboon (1982), he defined the term of environmental education as the process that develops population regarding to knowledge about living things and physical, social, and cultural environments, and awareness of the problem in order to find the solution and motivate people to have behavior in taking responsibility on the environment, which leads to quality of life.

From the definitions above, it can be concluded that environmental education means the process that educate people in order to develop them to understand about relationship between human and natural and artificial environments. It creates attitude, value, behavior and responsibility on conservation and development of the quality of the environment and human lives.

2.4.2 Objectives of environmental education

Environmental education is the process that educates the learners about the environment so that they will become effective persons. UNESCO determined the objectives of environmental education to change behaviors of the individuals and the societies as follows (UNESCO, 1976 : 2 – 3).

1. Awareness: To be aware and sensitive to environmental issues as well as related problems.

2. Knowledge: To have value and supportive feeling regarding to environmental issues and ready to participate in protecting and improving the environment.

3. Attitude: To have value and supportive feeling regarding to all environmental issues as well as problems, responsibilities, and roles of humans on the environment.

4. Skill: To have skills in solving environmental problems.

5. Evaluation ability: Able to evaluate environmental measures and study the project related to ecological, political, economic, social, aesthetic, and educational factors.

6. Participation: Develop the sense of responsibility in finding appropriate measures to solve environmental problems urgently.

2.4.3 Principle of environmental education

Environmental education management aims to educate the people and change their behaviors in the area of environment. However, to achieve the goal, it is necessary to have operational principle. Therefore, in operational meeting of the UNESCO in Belgrade, it determined the principle of environmental education as follows.

1. Environmental education should consider on all environments including natural and artificial environments in the aspects of ecology, politics, economy, technology, social, law, culture, and aesthetics.

2. Environmental education should be lifetime process arranged inside and outside of formal system.

3. Environmental education should be multidisciplinary.

4. Environmental education should emphasize on participation in protecting and solving environmental problems.

5. Environmental education should consider on global issues of environmental education while considering on regional differences.

6. Environmental education should emphasize on both current and future environmental situations.

7. Environmental education should consider on overall developments.

8. Environmental education should encourage awareness and necessity to participate in preventing and solving environmental issues in local, national and global levels.

2.4.4 Model of the environmental education in the operation

It is the form of environmental education used in every area, where land forest and mangrove forest exist. It can be separated into 2 major parts, including

formal environmental education and non-formal environmental education. It can be briefly concluded as follows (Department of Forestry).

1. Non-formal environmental education: Currently, people widely learn about the environment from non-formal institutes as follows.

1.1 Mass media (such as television, radio, newspaper, and magazine)

- Television allocate more broadcasting time for environment programs. Program category includes movie, documentary, news, game show about animal living, the program that brings the audiences to visit conservation groups, and environment-supportive program.

- Radio offers environmental programs. It uses environmental issues as the content to talk with the audiences. Music programs are from central and local radio stations.

- Many newspapers allocate their space for environment column. They report environmental updates sporadically. There are scoops about environmental issues interested by the people.

- Magazines and journals are another kind of publication supported by the audiences interested in certain environmental issues, for example, tourism, adventure, archaeology, camping, fishing, diving, gardening, and pets. These magazines usually have 1-2 columns offering information or knowledge about environmental theories.

1.2 Government and State Enterprise institutes are another group providing environmental knowledge for the public. They produce media and support third party for media production, including books and publications.

1.3 Private and independent organizations. This group can be separated into subgroups as follows. Non-profit group providing environmental education, this group usually run certain campaigns. It consists of knowledgeable persons with a lot of experiences. Some groups publicize through mass media. Some groups reach out target people directly. They might use artists, stars, singers, and song writers to reach the target group.

1.4 Religious group. This group can easily put environmental education into the people's mind based on their faith. They spread across all regions. This group is considered one good source of non-formal environmental education if it has the actual concept of environmental education. Supporting in the area of theory, practice, and necessary information to this group will make dissemination about environmental topic more efficient.

2. Environmental education in formal system covers environmental education in various formal systems of schools, colleges and universities with clear curriculums.

At present, it is found that Chanthaburi has environmental education separated into topics, such as ecological pollution, natural resources, water and soil resources, etc. The content is separated into chapters or inserted in relevant topic. This format is mostly found in formal education. Except for some institutes, they might bring their students to field trip. This cannot lead the learners to have capability in managing or making decision about environmental problems actually due to subjective environmental factors, such as social, economy, politics, and ethics. These concealed factors determine people's decision in doing activities. They are invisible. Therefore, the study must integrate many knowledge and theories together. For example, teaching about ecology, politics, economy, social, ethics, geography, history, and culture, etc. This will lead the learner to achieve the goal of environmental education (document of Department of Forestry and the interview with officers at 2nd mangrove forest development station, 2009).

In conclusion, environmental education is the process to instruct in order to change human's behaviors on the environment. Particular activities are applied to instruct the participants. Subjective environmental factors are related to people's decision in doing activities.

2.5 Non-Formal Environmental Education Concept

2.5.1 Meanings and theories

Unesco (1986) defined this term as the science in disseminating environmental knowledge by using appropriate and flexible technologies and methods depending on the target group. The target group is the population outside formal education system. The content emphasizes on solving environmental problem of base area.

2.5.2 Characteristics and forms of non-formal environmental education

Unesco (1986) classified non-formal environmental education into 2 types, namely non-formal environmental education with participation of target group and non-formal environmental education without participation of target group.

1) Non-formal environmental education with participation of target group consists of discussion, which is attended by one of these following groups, namely teacher, knowledgeable person, academician, environmentalist, advertiser, and practitioner in environmental education area. They come to lecture or discuss for the audiences in certain topic. This technique requires the least participation from the audiences. In addition, this learning process reflects the most tradition of non-formal environmental education.

Discussion in seminar room or the meeting is one technique of non-formal environmental education that clearly increases the audience's participation. The best result is achieved in group discussion with 10-15 members.

Problem solving is another technique of non-formal environmental education participated by target group. This technique raises important issue of the information or academic work on certain environmental topic so that the target group will consider and find the solution. The steps include creating awareness of the problem among target group and determining the problem, collecting and organizing and analyzing of the information, creating the guideline for procedure, evaluation, and alternatives for solution, developing procedural guideline and practice, and finally, evaluation.

Using native performance or local movie is considered an effective technique for non-formal environmental education with participation of target group. This is because entertainment can connect to interesting things. Using native language to communicate can create mutual understanding. Using community's culture for the performance can gather the community closely. Social activities belong to everyone in the community.

2) Non-formal environmental education without participation of target group consists of radio, television broadcast, newspaper column, visiting institute, such as museum and zoo. Non-formal environmental education without participation of target group is widely carried on, especially in developed countries. In recent decades, the increase of television programs about environmental issues, such as conservation, pollution, and starvation, is an indicator of public awareness on the importance of such problems. The form of non-formal environmental education without participation of target group has spread and recognized across the world. The important concern on this form of environmental education is creating entertainment and imagination for the audiences, leading to the change of public attitude.

In the expansion of non-formal environmental education without participation of target group, education structure and diverse activities and integration between activities are crucial for the countries with arising environmental issues. It is also related to lifestyle of people in those countries. Formal education system is usually ineffective due to the lack of budget, high turnover, and insufficient designation in high school level

In conclusion, non-formal environmental education is disseminating environmental knowledge by using appropriate technologies and flexible methods depending on target group. Target group is number of population. The content aims to solving urgent environmental issues.

2.6 Participation concept

2.6.1 Meaning of the concept and theory

Many persons have defined the term participation, which can be concluded as follows.

Yuwat Maythee (1983:20) defined the term participation as offering opportunity for the people to participate in initiating, making decision, operating, and taking responsibility in things that affect to the people themselves. All humans desire to live with the others happily. At the same time, humans are able to develop if they have chance and proper suggestion.

Taweethong Hongwiwat (1984:189) defined the term participation as self-development of the community in managing, controlling, spreading resources and production in the social to benefit in living in the aspect of economic and social as appropriate and suitable as social group members. This also includes the development and following up.

Somporn Saengchai (1984; cited in Surasak Worrapukboonya, 2004:7) defined the term participation as new method in developing rural area. One thing is to protect the ecology, develop, and use natural resources appropriately and economically. Allow the people to participate in planning so that the development will meet the need of the people and they will have the sense of belonging.

In conclusion, participation means allowing the people to participate in activities of the society they are living in. It starts from collectively think, act, invest, follow up, and evaluate. This is to satisfy their needs properly.

2.6.2 Characteristics and forms of participation

Pakorn Preeyakorn (1977; cited in Surasak Worrapukboonya, 2004:7) stated that people's participation in development is taking the role in collectively think, act, solve, and take profits together. It can be done in 4 ways as follows.

1. Having important role in determining of what is the basic need of the community.

2. Gather resources to satisfy basic needs.

3. Having the role in improving product and service distribution method to be better.

4. Being satisfied and motivated to create developmental process continuously.

Jermsak Pinthong (1984:10) concluded participation into 4 steps as follows.

1. Participation in finding problem and the cause of problem
2. Participation in operation planning
3. Participation in investment and operation
4. Participation in following up and evaluation

Chaichana Suthiworachai (1993) mentioned about people's participation that the people might participation decision making process. They might participate in carrying on the project by sacrificing resources, such as labor, material, money, or cooperation in the organization or certain activities, participate in receiving profits obtained from the development and participate in project evaluation attempt.

In conclusion, people's participation consists of collectively think, make decision, plan, act, invest, and take responsibility to solve problem or develop the society.

2.6.3 Factors that affect to participation

Reader (1963 : 39 – 53, cited in Phisit Boonchai,1985) concluded important factors that affect to people's participation in these following 11 important factors.

1. Self-practice according to basic belief: It can be said that individual or people seem to choose the practice that is corresponding and similar to their basic belief.

2. Norm of individual and group: It seems that people practice corresponding to their norm.

3. Goal of individual and group: It seems that people support, protect, and maintain their goal.

4. Strange experience and behavior of individual or group: Sometimes strange behaviors are based on unusual experience.

5. Expectation: Individual and group express behaviors as they expect to behave in such situation. They also like to treat the others as they expect from the others.

6. Self-center: Individual and group usually do what they think they should.

7. Oppression: Individual and group usually do things they feel they are forced to do.

8. Habit and tradition: Individual and group usually do things they are used to in such situation.

9. Opportunity: Individual and group usually participate in social practice related to number and type of the project depending on their supportive social structure that allow them to participate in such action.

10. Capability: Individual and group usually participate in certain activities they think they can do in such situation.

11. Support: Individual and group usually start practice when they feel that they or their group are well supported for such action.

2.7 Coastal Mangrove Forests of Eastern Provinces in Thailand and Research Areas Sampling

Figure 2.1 Map of Eastern Part of Thailand

Figure 2.2 Map of Chanthaburi (sampled areas)

2.7.1 Sampled area is Chanthaburi

1) Location and territory: Chanthaburi is located on eastern coast of the country. It is about 245 kilometers away from Bangkok. It occupies 6,338 square kilometers of the land or about 3,961,250 rai. It has 10 administrative districts, including Muang, Tamai, Klung, Lamsing, Pongnamron, Makham, Soidao, Nayaarm, Kanghangmaew, and Khaokitchakood. Its' population in April 2007 was 511,587 persons. The lands in the north and the east are mostly forests, mountains, and high hills. Its southern part is coastal low land. Some areas are bays. Average temperature is approximately 28.13 Celsius. Its neighboring provinces include:

The north: adjacent to Chonburi, Chachoengsao, and Sakeaw

The South: adjacent to Gulf of Thailand and Trat

The East: adjacent to Cambodia and Trat

The West: adjacent to Rayong and Gulf of Thailand

2) Geography: Geography of Chanthaburi can be classified into 3 types.

2.1 High mountains and hills: The northwestern part, Kanghangmaew district, is adjacent to Rayong and Chachoengsao. Chamoon, Chaaem, and Lamplai Prakaed mountains are the sources of branch watercourses of Tanode canal. Chanthaburi mountain is located at the north and the east. It consists of Soidaonuea mountain, Takienthong mountain, Phrabahtpluang mountain, Plung mountain, Soidaotai mountain, and Chanthaburi mountain. They lie down from the border of Sakeaw to the central part of the province and meet with Samngam mountain of Buntad mountain. Chanthaburi mountain covers the eastern area of Khaokitchakood district, the west of Soidao district and Pongnamron district. Samngam mountain is located in the south of Pongnamron district, the east of Nayaarm district, and the north of Klung district. Hills scatter all over every district.

2.2 Highland and foothill plain include the east part of Soidao mountain to the border of Thai-Cambodia, the area of Soidao district, Pongnamron district, the south of Samngam mountain, the central part of Klung district and the east of Makham district, another area between Soidao mountain and Chamoon mountain in the area of Kanghangmaew district, Khaokitchakood district, and the northern part of Tamai district.

2.3 River basin and coastal plain include the basin of Tanode canal flowing through Kanghangmaew district, Khaokitchakood district, Tamai district, Chanthaburi basin flowing through the western part of Makham district, Chanthaburi city, and Lamsing district. Phangrad basin has only branch watercourse in Nayaarm district flowing to meet with branch watercourse from Klang district, Rayong, and becomes Phang watercourse flowing along the border of Chanthaburi and Rayong to the south. Waeru basin flows from the north to the south in Klung district. The coastal plains include the southern land of Nayaarm district, Tamai district, Lamsing district and Klung district.

2.7.2 Information of study community

This research was conducted among people living in villages with mangrove forests. These consist of 5 districts, including 7 villages in Muang district, 22 villages in Klung district, 16 villagers of Nayaarm, 11 villages of Tamai, and 24 villages of Lamsing district, totally 13,778 households in 80 villages. The number of population was 44,082 persons.

2.8 Related researches

From the study on researches related to the form of environmental education for sustainable mangrove forest management, the researcher has collected related researches as follows.

Amaraporn Sripurjarean (2007) studied about environmental education of mangrove forest management for local community, Yisarn subdistrict, Amphawa district, Samutsongkhram. The study applied environmental education focusing on lecture and group discussing for exchanging experience. Media applied consisted of manual, document, real thing and video. The result showed that people had more knowledge, understanding, awareness, decision-making skill, and participation in mangrove forest management after completion of environmental education process.

Panan Nurancha (2007) studied about mobile phone residue management through environmental education activity for bachelor's degree students, Mahidol University. In the study, environmental education activity was held by creating website. The result showed that the website was efficient in improving behavior in eliminating mobile phone residue of the samples in environmental-friendly way. It was also able to develop knowledge, attitude, awareness, problem-solving skill and evaluation ability in eliminating mobile phone residue of the samples effectively.

Samran Rakchart (2005) studied about participation of the people in conserving mangrove forest at Waeru basin, Chanthaburi. The result showed that the factors related to people's participation in conserving mangrove forest were educational level, period of settlement, main occupation, household income, size of possessed land, training, experience in conserving forest resource and experience in working with the officers.

Sombut Thammachote (2005) studied about factors related to opinion of life quality development on the people under Kungkraben bay development center in royal idea, Chanthaburi. The result showed that the factors related to the opinion of life quality development for the people included main occupation and opinion on life quality.

Surasak Worrapakaboonya (2004) studied about factors related to people's participation on conserving mangrove forest at Bangkhuntian, Bangkok. The results showed that the factors related to people's participation in conserving mangrove forest included age, education, minor occupation, and being social group member.

Col.Prachoom Maturamon (2002) studied about participation process in determining environmental education strategy to develop the community in frontier self-defense village, Tungmaseryor village, Bongtee subdistrict, Saiyok district, Kanchanaburi. He integrated environmental education with military strategy. Each strategy has different activity. He also applied participatory operational research as a tool in informing the target group. From the operation, it was found that target population had high level of learning effectiveness.

Songkrod Poothong (2002) studied about factors that affect to local people on forest resource management in wildlife sanctuary, Bangphra reservoir, Chonburi. The result showed that factors affecting to people's thought in managing forest resource included occupation, educational level, number of family member, and gender.

Bunpot Maleehual (2001) studied about government policy and people's participation in conserving forest resource in Kungkraben wildlife sanctuary, Chanthaburi. He found that factors influencing on people's participation in conserving forest resource include major occupation, size of possessed land, and knowledge in utilizing forest resource.

Nicole Blume (2008) wrote an academic article in the topic of environmental education, sustainable development project in Costarica. She showed that the support in environmental education, national policy in education sector, national resource conservation, and conservative tourism promotion were improved simultaneously. This project applied formal and non-formal environmental education as learning medium about environment for the people.

Abdulla Soykan (2008) proposed academic article about environmental education based on ecology during 1999 – 2008 for reserved area in Turkey. He stated that environmental education based on ecology was used in national part and surrounding areas. The main goal was to be an alternative in solving ecological issues, which must be practices by emphasizing on using this alternative as cultural activity conducted on ecology in conserving reserved area. He found that environmental education based on ecology allowed participants in environmental education activities, who exchange their experiences, learn from real things, or learn in the class, to widely apply almost all activities.

Roy R. Lewis III (2004) studied on ecological engineering for good management and mangrove forest restoration in the United States. The method consisted of adjustment of ground level of deteriorated mangrove forest. The ground was sloped to be submerged under water during flood tide. Watercourse was dredged in order to drain water, so that inundation of each period relate to major plant species of mangrove forest. The results showed that there was expansion of mangrove forest on deteriorated area.

Santosh Kumar Sarkar and Asok Kumar Bhattachrya (2003) conducted research on coastal resource biodiversity conservation of Sundarban swamp in northeastern part of India using integration method through environmental education process. The result showed that local people were educated to make them understand about good practice and realize in using natural resources appropriately to conserve

natural resources of Sundarban swamp by applying environmental education. Activities included seminar, operational meeting, exhibition, and audiovisual education. After the implement of environmental education among the people, it was found that destruction of the nature around the area of Sundarban swamp had highly decreased.

Marion Glaser, Uta Berger and Rosangela Macedo (2003) conducted the research on local fragility in Para state in the north of Brazil. It was an advantage in managing mangrove forest in the condition of illegal action. It was found that the mangrove forest area in Para state was at risk of illegal invasion. Therefore, government institutes encouraged the community to set their social measure to protect mangrove forest and mutual utilization that does not change ecological system, for example, issuing community regulation in utilizing mangrove forest, collectively planning for project related to mangrove forest and protecting mangrove forest from the outsiders.

Maricar S. Samson and Rene N. Rollon (2008) studied about growing ability of newly-afforested mangrove forest in Philippines. In the return of mangrove forest management strategy, it was found that mangrove forestation in Philippines was mostly conducted by growing single species in inappropriate area. Thus, young plants had high death rate and number of substitutes were needed. Even survived or replaced plants were dwarfed. Therefore, reforestation strategy was adjusted by aiming to former mangrove forests, which were currently business animal farms. However, it depends on administration of the government and local organizations.

From researches mentioned above, it shows that the problem about inappropriate mangrove forest management or natural resource was due to the lack of knowledge and understanding in natural resources. Thing that must be urgently done for the existence of mangrove forest or other natural resources is to instruct the people about natural resources. The best medium in disseminating knowledge is environmental education.

CHAPTER III
RESEARCH METHODOLOGY

Research Process

In this research, the researcher divided the procedure into 3 steps. The first step is basic information review for quantitative research. This is to find the fact of problem and important factors that have the influence on people's participation in solving problem. The second step is the design of environmental education model by using qualitative research based on "PAR" (Participatory Action Research) as driver and integrator to create environmental education model. The final step is arranging environmental education activity and evaluation on environmental education model. The detail of each steps are as follows.

3.1 Step of basic information review

The step of basic information review aims to study about:

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

(2) Important factors that affect to people's participation in sampled study areas in eastern provinces.

Objective of basic information review

(1) To support in the design of environmental education model

The researcher prepared basic information survey about mangrove forest management in eastern provinces as follows.

3.1.1 Population and sample group

Sample study areas randomly from 5 eastern provinces, including Trat, Chanthaburi, Rayong, Chachoengsao, and Chonburi. The result of study area sampling was Chanthaburi, where mangrove forest covers 5 districts as shown below.

Table 3.1 Villages with mangrove forest area in Chanthaburi

Mangrove forest area		**Number of household (family)**	**Number of population (person)**
Muang district	Bangkaja subdistrict		
	mu.1 (Bangkaja)	326	1,044
	mu.4 (Kao)	541	1,332
	mu.9 (Khaonoi)	643	1,550
	mu.10 (Tachalaab)	200	712
Total	4 villages	1,710	4,638
	Nhongbua subdistrict		
	mu.7 (Nhongbua)	298	813
	mu.10 (Samedngam)	144	448
	mu.11 (Samedngam)	221	645
Total	3 villages	663	1,906
Total of the district	7 villages	2,373	6,544
Lamsing district	Bangsakao subdistrict		
	mu.1 (Nern)	225	748
	mu.2 (Klang)	103	340
	mu.3 (Nernklang)	96	312
	mu.4 (Konghin)	153	396
	mu.5 (Lang)	104	394
Total	5 villages	681	2,190

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population (person)
Lamsing district	Klongnamkem subdistrict		
	mu.1 (Taruea))	91	244
	mu.2 (Bangkien)	87	214
	mu.5 (Klongnamkem)	64	128
	mu.6 (Nernpoe)	197	710
Total	4 villages	439	1,296
	Bangkachai subdistrict		
	mu.1 (Lamsing)	206	533
	mu.2 (Lampradu)	145	387
	mu.3 (Klongpladuk)	183	663
	mu.4 (Bangkachai)	142	335
	mu.5 (Bangkachai)	142	420
	mu.7 (Rueatak)	122	333
	mu.8 (Huakhao)	149	528
	mu.9 (Aowmu)	90	289
Total	8 villages	1,179	3,488
	Nhongchim subdistrict		
	mu.7 (Khaonoi)	177	638
	mu.8 (Emui)	119	456
	mu.9 (Khaochongkron)	193	646
	mu.10 (Maipattana)	144	615
Total	4 villages	633	2,355

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population (person)
Lamsing district	Korperd		
	mu.4 (Khaotanuay)	207	545
	mu.6 (Pakklong)	173	677
	mu.7 (Klonghok)	77	260
Total	3 villages	457	1,482
Total ทั้งอำเภอ	24 villages	3,389	10,811
Tamai district	Kamong subdistrict		
	mu.1 (Kamong Lang)	106	682
	mu.6 (Korkwang)	149	716
Total	2 villages	255	1,398
	Klongkhud subdistrict		
	mu.4 (Mudud)	199	635
	mu.7 (Kungkraben)	60	172
	mu.8 (Amphawa)	158	540
Total	3 villages	417	1,347
	Takadngao subdistrict		
	mu.1 (Takadngao)	234	876
	mu.5 (Tatai)	288	1,124
	mu.6 (Sriwut)	203	742
	mu.10 (Samngam)	93	356
Total	4 villages	818	3,092

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population (person)
Tamai district	Sipaya		
	mu.8 (Samrong)	42	117
	mu.10 (Tungkaituen)	55	208
Total	2 villages	97	325
Total of the district	11 villages	1,587	6,162
Nayaarm district	Krajae		
	mu.1 (Paknamkrajae)	115	387
	mu. 3 (Nasa)	154	623
	mu.9 (Nhongbua)	100	384
Total	3 villages	369	1,394
	Changkam subdistrict		
	mu.2 (Aitui)	65	250
	mu.4 (Plongyai)	135	558
	mu.5 (Changkham)	125	495
	mu.8 (Tanonsoong)	60	172
	mu.9 (Troklang)	58	225
	mu.10 (Khaodun)	121	422
	mu.11 (Chakman)	165	624
	mu.12 (Nhongsai)	92	254
	mu.13 (Kungtakean)	108	357
Total	9 villages	929	3,357

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population (person)
Nayaarm district	Nayaarm subdistrict		
	mu.2 (Poelungka)	197	345
	mu.4 (Klongchak)	99	364
Total	2 villages	296	709
	Sanamchai subdistrict		
	mu.4 (Paktapone)	97	309
	mu.7 (Taklang)	26	920
Total	2 villages	123	1,229
Total of the district	16 villages	1,717	6,689
Klung district	Bor subdistrict		
	mu.1 (Nhongrahaan)	320	991
	mu.2 (Whak)	160	596
	mu.3 (Borbon)	208	711
	mu.4 (Borlang)	155	595
	mu.5 (Huana)	219	776
	mu.7 (Tasorn)	203	595
Total	6 villages	1,265	4,264

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population (person)
Klung district	Wanyao subdistrict		
	mu.1 (Korkwang)	210	592
	mu.3 (Tamakham)	124	461
	mu.4 (Wanyaolang)	325	1,015
	mu.6 (Suenglang)	258	792
	mu.7 (Engaw)	225	696
	mu.8 (Klongtakien)	154	491
Total	6 villages	1,296	4,047
	Kweanhak		
	mu.5 (Kweanhak)	98	307
	mu.8 (Namchu)	138	425
	mu.10 (Huaang)	485	890
Total	3 villages	721	1,622
	Tapon		
	mu.1 (Taponyai)	50	183
	mu.2 (Taponyai)	183	637
Total	2 villagers	233	820

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Table 3.1 Villages with mangrove forest area in Chanthaburi (cont.)

Mangrove forest area		Number of household (family)	Number of population person)
Klung district	Bangchan		
	mu.2 (Paknamwaeru)	478	1,140
	mu.3 (Ithep)	199	478
	mu.4 (Takhayang)	157	360
	mu.5 (Nakung)	135	418
	mu.6 (Seelumtien)	228	727
Total	5 villages	1,197	3,123
Total of the district	22 villages	4,712	13,876
Total of 5 districts	20subdistricts/80villages	13,778	44,082

Source: 2nd mangrove forest development station (Tasorn, Chanthaburi) (2011)

Select the samples as household representatives by using multiple-steps sampling method as follow.

1) Sample for 1 district from 5 target district by using simple random sampling. Lamsing district was selected.

2) Sample for 1 subdistrict from previously-chosen district by using simple random sampling. Bangsakao was selected.

3) Find the samples of subdistrict level among 681 households in Bangsakao subdistrict by applying statistic formula of Taro Yamane (1973: 725). The number of sample households is 252 or about 300 households.

4) Separate 300 sample households into sample groups of each village in ratio.

5) Find target households among sample groups of each villages by drawing lots according to calculated number.

Table 3.2 The number of target households in each village of Bangsakao subdistirct

Mangrove forest area		Number of households (family)	Number of target households (family)
Lamsing district	Bangsakao subdistrict		
	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) (2011)

3.1.2 Research tools

The tools consist of questionnaire and test. The details are as follows.

Part 1 is general questions about target group, namely gender, age, occupation, educational level, income, number of family members, period of settlement, size of possessed land, being social group member, receiving information and source of information, experience in mangrove forest management or conservation.

Part 2 is knowledge test about mangrove forest management or conservation. The questions are 10 true-false questions.

Part 3 is evaluation of participation and frequency in mangrove forest management or conservation. The questions are multiple choices, namely used to, never, and number of participation.

3.1.3 Validity/reliability test of the questionnaire

1) Find validity of the questionnaire in order to check whether the questionnaire covers all aspects needed for the study. This was made by proposing the questionnaire to the committee of experts specialized on mangrove forest conservation to review and revise the content to be comprehensive and correct.

2) Find reliability of the questionnaire in order to check whether the questionnaire is consistent. This was made by testing 40 revised questionnaires with the people living in villages nearby mangrove forests in Klongnamkem subdistrict, Lamsing district, Chanthaburi. Then analyze to fine reliability of the questionnaire as follows.

Find index of difficulty, discrimination power, and reliability of the questionnaire about mangrove forest management knowledge. The criterion in choosing the questionnaire is index of difficulty ranges from 0.20 – 0.80, discrimination power is 0.20 and above, and reliability is 0.70 and above according to the law of Cuder Richardson 20.

The result of validity/reliability test on the questionnaire

Table 3.3 The result of quality test on the questionnaire on mangrove forest management understanding showed ICO value at 0.96 throughout the form

Questions about mangrove forest management knowledge and understanding	P	D
1. Mangrove forest area is important habitat of aquatic animals only.*	0.82	0.36
2. Coastal aquatic animal breeding, which gentrifies the land in mangrove forest area, such as prawn farm, affects to mangrove forest ecology and decrease the amount of mangrove forest area.	0.73	0.55
3. Land reclamation or gentrification on mangrove forest area for agricultural purpose, residence, or other activities is more beneficial than living it as natural mangrove forest.*	0.73	0.55
4. Mangrove forest forestation or conservation should be the responsibility of government institutes only.*	0.82	0.36
5. Mangrove forest forestation increases mangrove forest area. It is able to prevent or reduce severity of the storm or tide.	0.82	0.36
6. Amount of land and fertility of mangrove forest affect to the increase or decrease of aquatic animal population, which is people's important food source.	0.73	0.55
7. Mangrove forest area is very important in treating waste from the community, such as dirty water, before draining to the sea.	0.59	0.82

Table 3.3 The result of quality test on the questionnaire on mangrove forest management understanding showed ICO value at 0.96 throughout the form (cont.)

Questions about mangrove forest management knowledge and understanding	P	D
8. The amount of woods in mangrove forest directly affects to the increase of coastal area due to the increase of soil deposition, which replaces eroded area appropriately.	0.73	0.55
9. Diversity of plant and animal species living in mangrove forest can be applied for conservative tourism, which increases part-time jobs and additional income for the community.	0.82	0.36
10. The development of school or academic institute in the community as the source of knowledge, academic matter, and research on mangrove forest management for the community is important for solving mangrove forest issue.	0.82	0.36

Note: Discrimination power (D) and index of difficulty (D) used technique 27% according to Johnson's method.

Reliability (r) according to the law of Cuder Richardson 20 was equal to 0.712.

Table 3.4 The result of quality test on mangrove forest management attitude showed ICO value at 0.87 throughout the form

Statement	D
1. Mangrove forest management issue belongs to everyone in the community to participate in solving it.	0.519
2. The current mangrove forest management issue must be solved urgently.	0.495
3. Mangrove forest reforestation in abandoned aquatic animal farm increase difficulty and it is not people's responsibility.**	0.323
4. Running campaign to decrease the use of mangrove forest area is important at present.	0.389

Table 3.4 The result of quality test on mangrove forest management attitude showed ICO value at 0.87 throughout the form (cont.)

Statement	D
5. Gentrification for aquatic animal breeding in mangrove forest area can be conducted since it does not affect to mangrove forest ecology.**	0.268
6. The campaign should be run to make the people realize the benefits of mangrove forest and increase more knowledge about mangrove forest management for the people.	0.212
7. Aquatic animal breeding in mangrove forest area is important activity that should be reduced since it affect to the decrease of mangrove forest area.	0.215
8. The proprietor, who uses mangrove forest area, must be responsible to the decrease of mangrove forest area.	0.617
9. Mangrove forest reforestation and the decrease of mangrove forest utilization must be followed by the people in the current situation.	0.686
10. Business owners, factories, and people living in mangrove forest area must have supportive measure in order to reduce the impact on mangrove forest.	0.665

Note: Discrimination power (D) used technique 25% according to Likert's method. Reliability (r) according to the Conbarch's law was equal to 0.754.

Table 3.5 The result of quality test on awareness in mangrove forest management showed ICO value at 0.901 throughout the form

Statement	D
1. Do not release pollutant from the factory to mangrove forest because toxin will be accumulated in aquatic animals and plants, which are human foods. It can be transferred to human.	0.222
2. Do not breed aquatic animals in mangrove forest area because it will increase negative impact on mangrove forest issue too much.	0.205
3. Buildings in industrial sector and public utilities, which have not been studied comprehensively, can cause the problem on mangrove forest management.	0.480
4. Community expansion, such as construction of buildings and houses, should not intrude into mangrove forest area. This will permanently destroy mangrove forest area and reduce the amount of aquatic animals.	0.619
5. Building pier and dredging watercourse increasingly do not affect to mangrove forest ecology.**	0.201
6. The decrease of mangrove forest area causes economic and social impacts on the community.	0.377
7. Mangrove forest area, which is permanently deteriorated until cannot be used for any purpose, will cause long-term problem in mangrove forest management.	0.447
8. Digging the soil out of mangrove forest area destroy s mangrove forest ecology.	0.504
9. Mangrove forest protection measures should be appropriate and ready for the change in order to maintain mangrove forest area.	0.598
10. Destroying mangrove forest area does not affect to food chain of the people living in that mangrove forest area.**	0.258

Note: Discrimination power (D) used technique 25% according to Likert's method.
Reliability (r) according to the Conbarch's law was equal to 0.716.

Table 3.6 The result of quality test on problem-solving skill in mangrove forest issue showed IOC value 0.93 throughout the form

Statement	D
1. Important cause of the decrease of mangrove forest area is invasion for business aquatic animal breeding.	0.441
2. The problem of coastal erosion is more severe when mangrove fore are decreases.	0.556
3. Constructions in mangrove forest area does not affect to mangrove forest ecology.**	0.456
4. Invasion of mangrove forest is caused by insufficient legal enforcement.	0.458
5. Best solution on mangrove forest issue is to decrease or stop using mangrove forest area for every purpose.	0.518
6. Surveillance and prevention against invasion on mangrove forest area is responsibility of the officers only.**	0.239
7. Running campaign to prohibit people from living in mangrove forest area as well as forestation in mangrove forest is important for the community in solving mangrove forest issue.	0.432
8. Gentrification on the coast is one cause that affects to the decrease of mangrove forest area.	0.413
9. Good method in mangrove forest management is collaboration of all sectors in the social.	0.442
10. Mangrove forest management that focuses on both direct and indirect profits for the people is considered an appropriate mangrove forest management at present.	0.421

Note: Discrimination power (D) used technique 25% according to Likert's method. Reliability (r) according to the Conbarch's law was equal to 0.765.

Table 3.7 The result of quality test on mangrove forest management evaluation ability showed IOC value at 0.93 throughout the form

Statement	D
1. In the future, if local administrative organization has more roles in managing mangrove forest, the problem will decrease.	0.482
2. Teaching through media or intense advertising helps reduce mangrove forest problems at certain level in the future.	0.530
3. Without effective mangrove forest management, the problem will be more severe.	0.506
4. In the future, although the community and local administrative organization have good and intensive measures in managing mangrove forest, it will not have any impact on mangrove forest issue.**	0.265
5. In the future, if the people know and cooperate with the projects related to mangrove forest management, the problem will be relieved.	0.554
6. Issuing strict measure and punishment does not have any impact on solving mangrove forest problem.**	0.210
7. If aquatic animal breeders or large businesses related to mangrove forest utilization stop using mangrove forest area, it will decrease the impact on mangrove forest ecology.	0.698
8. If the communities living nearby mangrove forest are not alert about mangrove forest management, mangrove forest area will be used inappropriately leading to the loss of ecology.	0.440
9. If the communities have their own mangrove forest management system, mangrove forest area will remain with the communities forever. This also reduces government budget.	0.243
10. Severity of erosion on river bank or the coast and the storm blowing the coast will increase if mangrove forest area is decreasing continuously.	0.524

Note: Discrimination power (D) used technique 25% according to Likert's method. Reliability (r) according to the Conbarch's law was equal to 0.771.

Part 4 Interview about the development of participatory environmental education for sustainable mangrove forest management in eastern part of Thailand

1. What type of environmental education model or behavior-changing process does your institute or your project use to manage mangrove forest? How does it apply?

2. What model of environmental education or behavior-changing process do you think is the best for your institute or your project? Why do you think it is the best environmental education model?3. What composition, such as objectives and policies of mangrove forest management, purpose of environmental education model, content and other things in environmental education model or behavior-changing process, do you think optimally influence on mangrove forest management of the institute or project? How does it important for environmental education model?

4. Factors and special conditions that support your institute or project to be successful in mangrove forest management

5. Problems and obstacles of you institute or project about mangrove forest management

6. Method or guideline on solution and obstacles in mangrove forest management that your institute or project apply

Table 3.8 The result of quality test on the development of participated environmental education model for sustainable mangrove forest management in eastern part of Thailand

Objectives	**Interview**	**Score of experts' opinions**			**Total**	**IOC**	**Conclusion**
		1st person	**2nd person**	**3rd person**			
1. Environmental education model	item 1	1	1	1	3	1	Valid
	item 2	1	1	1	3	1	Valid
	item 3	1	1	1	3	1	Valid
2. Factors and special conditions	item 4	1	1	1	3	1	Valid
	item 5	1	1	1	3	1	Valid
	item 6	1	1	1	3	1	Valid
Average						**1**	**Valid**

3.1.4 Data collection

The data collected for this part of the study consists of 2 data types.

1) Secondary data included the information obtained from literature review that related to factors affecting to humans and mangrove forest management or conservation, information of study area, and relevant researches.

2) Primary data from the survey on target area and inquiry, 300 heads of the families or representatives, who were able to give the information well, were chosen from target group living in target area.

3.1.5 Data analysis

To verify collected questionnaires for completeness and correctness of the information by using Statistical Package for Social Sciences : SPSS according to this following method.

1) General information of the population included gender, age, occupation, educational level, income, number of family members, period of settlement, size of possessed land, receipt of information and information source, being social group member, and experience in mangrove forest management or conservation. The analysis was analyzed by using percentage, frequency distribution, mean, and standard deviation. Grouping of general information was calculated by adding or subtracting mean with standard deviation ($\overline{X}$ + S.D.).

2) Information about mangrove forest management knowledge was analyzed the information by using frequency, mean, and standard deviation.

3) Information about factors affecting to people's participation behavior in mangrove forest management or conservation, was analyzed the information by using Hierarchical Regression method. Indicate mean, standard deviation, table showing 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.

3.2 Environmental Education Model Design Process

Environmental education model design process aims to:

(1) Analyze environmental education model for mangrove forest management in successful institutes.

(2) Find important compositions of environmental education and other factors or conditions that influence to the success of the project or institute.

Objectives of environmental education model design

(1) Obtain appropriate environmental education model for mangrove forest management.

The researcher prepared the process in environmental education process design as follows.

3.2.1 Specify the criterion used to identify successful projects or institutes, including

1) The projects or institutes that have achieved the goal. The duration of the project or the institute must be over 3 years.

2) The projects or institutes have systematization or secure systemic management.

3) Sufficient basic factors for management, including officers, budget, management process, material and durable articles as well as appropriate communication and technologies.

4) Approved or certified by reliable institutes of government or private sectors as successful project or institute.

3.2.2 Target project

It is purposive sampling from previously-determined criterion, including:

1) Kungkraben bay education and development center in royal idea, Chanthaburi

2) 2nd mangrove forest resource development station (Tasorn, Chanthaburi)

3) 3rd mangrove forest resource development station (Klung, Chanthaburi)

4) Banprednai community in Huangnamkhao subdistrict, Muang district, Trat.

3.2.3 Key informant

Persons or representatives from government and private sectors related to mangrove forest management were chosen specifically (purposive sampling), including:

1) The director or representative of Kungkraben bay education and development center in royal idea, Chanthaburi

2) The head or representative of 2nd mangrove forest resource development station (Tasorn, Chanthaburi)

3) The head or representative of 3rd mangrove forest resource development station (Klung, Chanthaburi)

4) Section chief or representative of Natural and Environmental Resources Unit, Chanthaburi

5) The head or representative of Natural and Environmental Resources Division of Chanthaburi administrative organization

6) The chairman or representative of Chanthaburi administrative organization

7) The chairman or representative of Bangsakao district administrative organization, Chanthaburi

8) Member of provincial council or representative, Lamsing district, Chanthaburi

9) Community leaders of Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons from each area

10) Representatives of heads of the families in Bangsakao subdistrict, Lamsing district, Chanthaburi, 1 person from each area

11) Representatives from aquatic animal breeders in Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons form each area

12) The director or representative of Bangsakao school

13) Representatives from mangrove forest environmental conservation group of Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons

14) Representatives from Banprednai mangrove forest conservation group in Huangnamkhao subdistrict, Muang district, Trat, 2 persons

Table 3.9 Key Informant in the study for environmental education model development

Key Informant	Number (person)
1. The director or representative of Kungkraben bay education and development center in royal idea, Chanthaburi	1
2. The head or representative of 2nd mangrove forest resource development station (Tasorn, Chanthaburi)	1
3. The head or representative of 3rd mangrove forest resource development station (Klung, Chanthaburi)	1
4. Section chief or representative of Natural and Environmental Resources Unit, Chanthaburi	1
5. The head or representative of Natural and Environmental Resources Division of Chanthaburi administrative organization	1
6. The chairman or representative of Chanthaburi administrative organization	1
7. The chairman or representative of Bangsakao district administrative organization, Chanthaburi	1
8. Member of provincial council or representative, Lansing district, Chanthaburi	1
9. Community leaders of Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons from each area	10
10. Representatives of heads of the families in Bangsakao subdistrict, Lamsing district, Chanthaburi, 1 person from each area	5

Table 3.9 Key Informant in the study for environmental education model development (cont.)

Key Informant	Number (person)
11. Representatives from aquatic animal breeders in Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons form each area	10
12. The director or representative of Bangsakao school	1
13. Representatives from mangrove forest environmental conservation group of Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons	2
14. Representatives from Banprednai mangrove forest conservation group in Huangnamkhao subdistrict, Muang district, Trat, 2 persons	2
Total samples	38

3.2.4 The development of environmental education model for mangrove forest management

The development of environmental education model applies participatory action research method (PAR) to propel and integrate by taking successful environmental education model or the main model of target institutes or projects into analysis and collectively synthesize by all stakeholders to become environmental education model that covers successful factors of every integrated project as much as possible. The research method is as follows.

1) Collectively study on successful environmental education model of each project or institute whether what model and important composition the target institute or project successfully applied for mangrove forest management.

2) Collectively analyze the most successfully environmental education model of each project or institute. This means environmental education model that the target institute or project had used and found most effective for teaching the people leading to behavioral changes, which is good for mangrove forest management, and important compositions.

3) Collectively synthesize environmental education model appropriate for mangrove forest management in Chanthaburi.

After that, assemble the information derived from primary study into new environmental education model under the principle by the researcher. At the same time, it must be under supervisor of the expert in the area of mangrove forest management and environmental education. **The newly-obtained environmental education model will contain important compositions with common characteristics from the most effective environmental education model of successful institutes or projects.** It consists of these following compositions.

1) Mangrove forest goals and policies mean what the government require regarding to mangrove forest.

2) Environmental education model aims mean the result needed to occur to the persons, who have passed environmental education process.

3) Types and structures of environmental education model mean characteristics and diagram showing environmental education activities.

4) Activity objectives of environmental education mean the result needed to occur to the participants after having attended such activities.

5) Content means knowledge, skill, capability, and experience required to be learnt by participants.

6) Instructional objectives mean knowledge, skill, and capability required to be learnt by participants after studying on the content.

7) Activity strategy means appropriate environmental education activities with regulation for the achievement of learning objectives.

8) Evaluation means the learning assessment for the improvement, running activities, and environmental education model.

9) Materials and media mean documents, publications, films, CDs, and materials that support quality and effectiveness of teaching.

10) Context conditions of each project mean special characteristics or limitation that affect to the success of the institute or the project.

3.3 Environmental Education Activity and The Evaluation of Environmental Education Model

Environmental education activity is arranging activity according to the process and the content of environmental education model derived from environmental education development and environmental education model evaluation. It aims to:

(1) Analyze and find the fault of environmental education model for mangrove forest management obtained from the development.

(2) Evaluate efficiency and effectiveness of environmental education model for mangrove forest management.

Objective of environmental education activity and environmental education evaluation

(1) Obtain environmental education model for efficient and effective mangrove forest management for Chanthaburi.

The researcher prepared the process for environmental education activity and environmental education model evaluation as follows.

Target group (target area)

↓

Conduct the survey before environmental education activity, including:

1. Knowledge, understanding about mangrove forest management
2. Awareness and sensitivity on mangrove forest issue
3. Attitude and supportive feeling about mangrove forest management
4. Problem-solving skill on mangrove forest issue
5. Evaluation ability on measures for the problems
6. Participatory level in solving mangrove forest management

↓

Arrange the environmental education activity according to developed environmental education model

↓

Conduct evaluation form after environmental education activity, including:

1. Knowledge, understanding about mangrove forest management
2. Awareness and sensitivity on mangrove forest issue
3. Attitude and supportive feeling about mangrove forest management
4. Problem-solving skill on mangrove forest issue
5. Evaluation ability on measures for the problems
6. Participatory level in solving mangrove forest management

3.3.1 Sample group

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

3.3.2 Experiment process

The form of experiment is one group pretest –posttest design without control group.

Experiment process is that before environmental education activity, the samples were asked to complete the test before doing activity (Pre-test). After that, the samples do environmental education activity. Then the samples were asked to complete the test after environmental education activity (Post-test).

3.3.3 Data analysis

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

CHAPTER IV
RESEARCH RESULTS

4.1 Results of Primary Information Study

In the study on primary information, the presentation is separated into 3 aspects as follows.

4.1.1 General information of the population consists of gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information, information source of the population, being social group membership, and experience in mangrove forest management or conservation. Statistics applied for analysis include percentage, frequency distribution, mean, and standard deviation.

4.1.2 The information of mangrove forest management was analyzed using frequency distribution, mean and standard deviation.

4.1.3 The information of factors that affect to people's participation in mangrove forest management or conservation was analyzed using Hierarchical Regression. Present mean, standard deviation, the tables showing factors related to people's participation in mangrove forest management, prediction power on the factors that affect to people's participation in mangrove forest management and regression equation.

4.1.1 General information of the samples

Bangsakao subdistrict, Lamsing district, Chanthaburi consists of 5 villages, namely mu.1 Bannern, mu.2 Banklang, mu.3 Bannernklang, mu.4 Bankonghin, and mu.5 Banlang. The total number of households is 681 and the number of population is 2,190.

General information of the samples was collected from 288 questionnaires from 288 samples. The questionnaire includes gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation.

Table 4.1 The number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation)

Characteristics of the samples	Number	Percent	Note
1.Gender			
Male	92	31.90	
Female	196	68.10	
Total	288	100.00	
2.Age			Mean = 42.78
Under 21 years	4	1.40	Maximum = 84
21 – 30 Years	44	15.30	Minimum = 18
31 – 40 Years	85	29.50	S.D. = 12.83
41 – 50 Years	98	34.00	
51 – 60 Years	29	10.10	
60 Years and above	28	9.70	
Total	288	100.00	
3.Education			
Lower primary education	50	17.36	
Upper primary education	71	24.65	
Lower secondary school	63	21.88	
Upper secondary school	67	23.26	
Diploma or equivalent	14	4.48	
Bachelor’s degree	23	7.99	
Total	288	100.00	

Table 4.1 The number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation) (cont.)

Characteristics of the samples	Number	Percent	Note
4.Major occupations			
Prawn farm	64	22.22	
Fish farm	14	4.86	
Clam farm	2	0.69	
Crab farm	5	1.74	
Fishery	24	8.33	
Gardening	61	21.18	
Farming	8	2.78	
Growing vegetables	3	1.04	
Integrated agriculture	13	4.51	
Poultry farm	3	1.04	
General employee	60	20.83	
Trading	19	6.62	
Government service	6	2.08	
Others	6	2.08	
Total	288	100.00	
5.Annual income			Mean = 251,848.13
Less than 50,001 Baht	9	3.13	Maximum = 1,000,000
50,001 – 250,000 Baht	168	58.33	Minimum = 30,000
250,001 – 450,000 Baht	83	28.82	S.D. = 163,033.20
450,001 – 650,000 Baht	20	6.94	
650,001 – 850,000 Baht	4	1.39	
More than 850,000 Baht	4	1.39	
Total	288	100.00	

Table 4.1 The number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation) (cont.)

Characteristics of the samples	Number	Percent	Note
6.Number of household members			Mean = 4.52
Less than 3 persons	19	6.60	Maximum = 10
3 persons	60	20.80	Minimum = 2
4 persons	87	30.20	S.D. = 1.60
5 persons	52	18.10	
More than 5 persons	70	24.30	
Total	288	100.00	
7.Period of settlement			Mean = 27.02
Less than 21 years	138	47.90	Maximum = 81
21 – 40 years	81	28.10	Minimum = 1
41 – 60 years	50	17.40	S.D. = 18.07
61 – 80 years	17	5.90	
More than 80 years	2	0.70	
Total	288	100.00	
8.Size of possessed land			Mean = 10.00
Less than 11 rai	181	62.85	Maximum = 50
11 – 20 rai	72	25.00	Minimum = 0.5
21 – 30 rai	30	10.42	S.D. = 8.64
31 – 40 rai	3	1.04	
41 – 50 rai	2	0.69	
Total	288	100.00	

Table 4.1 The number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation) (cont.)

Characteristics of the samples	Number	Percent	Note
9.Receiving information about mangrove forest management			
Receive	276	95.80	
Do not receive	12	4.20	
Total	288	100.00	
10.Source of information			N = 288
Television	241	83.70	
Newspaper/journal/magazine	136	47.20	
Radio	124	43.10	
Internet	59	20.50	
Brochure/flyer/poster	90	31.20	
Government officer or volunteer	74	25.70	
Family member	71	24.70	
Neighbor	84	29.20	
Colleague	44	15.30	
Meeting/training/seminar	77	26.70	
Academic institute	84	29.20	
Others	7	2.40	
11.Social group membership			
No membership	114	39.60	
Membership	174	60.40	
Total	288	100.00	

Table 4.1 The number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and source of information, social group membership, and experience in mangrove forest management or conservation) (cont.)

Characteristics of the samples	Number	Percent	Note
12.Membership			N = 174
Community leaders	76	43.68	
Volunteer women and housewives	43	24.71	
Volunteer youths	2	1.15	
Natural conservatives	9	5.17	
Other groups	44	25.29	
Total	174	100.00	
13.Experience in mangrove forest management			N = 288
Yes	229	79.50	
No	59	20.50	
Total	288	100.00	
14.Level of mangrove forest management			Criterion of grouping:
Little experience (1 time)	47	20.49	$\overline{X}$ + S.D.
Medium experience (2-4 times)	142	61.81	$\overline{X}$ = 2.35 ,
High experience (5 times or above)	40	17.70	S.D. = 2.131

From Table 4.1, it was found that most responders, who live nearby mangrove forest area in Chanthaburi, were female, 68.10%, and male, 31.90%. Their average age is 43 years (mean = 42.78). Most samples' education level is upper primary school (grade 4-6) or 24.65%. Most of them do prawn farm, 22.22%. The average income of each family is 250,000 Baht per year (mean = 251,848.13). The

average number of family members is 5 persons (mean = 4.52 persons). Moreover, it was found that most samples settled on the current area for 27 years averagely (mean = 27.02). The average size of possessed land is 10 rai (mean = 10.00).

About receiving information about mangrove forest management, most samples, 95.80%, received mangrove forest management information from television as the main source, 83.70%. It was also found that most samples were social group members, 60.40%. Most of them were members of community leader group, 43.68%, from all samples, who are social group members.

About mangrove forest management experience among the samples, it was found that 79.50% of them have experience in mangrove forest management 2 times on the average (mean = 2.35). When rank experience level of mangrove forest management, it was found that most samples had experience at low level, 42.00%.

4.1.2 Information about Mangrove Forest Management Knowledge

From information analysis by using the questionnaire, containing 10 questions, to measure knowledge and understanding in mangrove forest management, the result is present in Table 4.2.

Table 4.2 Number, percentage, and mean of knowledge and understanding in mangrove forest management classified by items

Statement	Correct (percent)	Incorrect (percent)
1.Mangrove forest area is important habitat of various aquatic animals only*	200(69.40%)	88(30.60%)
2.Coastal aquatic animal breeding by gentrification in mangrove forest area, such as prawn farming, affects to mangrove forest ecology as well as the decrease of mangrove forest area.	233(80.90%)	55(19.10%)
3.Reclamation or gentrification to mangrove forest area for agricultural purpose, residence, or other activities cause more benefits rather than leaving it as natural mangrove forest.*	209(72.60%)	79(27.40%)

Table 4.2 Number, percentage, and mean of knowledge and understanding in mangrove forest management classified by items (cont.)

Statement	Correct (percent)	Incorrect (percent)
4.Forestation or conservation of mangrove forest should be responsible by government institutes only.*	217(75.30%)	71(24.70%)
5.Forestation increase mangrove forest area. It is able to prevent or reduce severity of storm or tide.	272(94.40%)	16(5.60%)
6.The amount of land and fertility of mangrove forest affect to the increase or decrease of aquatic animal population, which are people's important food source.	236(81.90%)	52(18.10%)
7.Mangrove forest area is very important in treating community's waste, such as waste water, before releasing to the sea.	218(75.70%)	70(24.30%)
8.Amout of woods in mangrove forest directly affect to the increase of coastal area due to the increase of soil deposition, which appropriately replaces eroded area.	232(80.60%)	88(19.40%)
9.Diversity of plant and animal species in mangrove forest can be applied for conservative tourism, which offers additional jobs and income for the community.	257(89.20%)	31(10.80%)
10.The development of schools or academic institutes in the community, leading to the source of knowledge, academic matter, and research on mangrove forest management for the people is important in solving mangrove forest issue.	242(84.00%)	46(16.00%)
Mean = 8.04 S.D.= 1.749 Minimum = 3.00 Maximum = 10.00		

From Table 4.2, it was found that 288 samples had 8.04 average knowledge scores (from total 10 scores) and standard deviation was 1.749.

When classified the score of mangrove forest management knowledge into 3 levels based on the group and measured normal distribution of the information by using mean and standard deviation, the results were obtained as shown in Table 4.3.

Table 4.3 Number and percentage of the samples classified by level of knowledge and understanding in mangrove forest management

Knowledge level	Number	Percent
Low level of knowledge (< 6 scores)	33	11.46
Medium level of knowledge (6-9 scores)	188	65.28
High level of knowledge (10 scores)	67	23.26
Total	288	100.00

From Table 4.3, it was found that most samples, 188 persons, had medium level of knowledge (65.28%). The next group of samples, 67 persons, had high level of knowledge (23.26%). The samples with low level of knowledge were 33 persons (11.46%).

4.1.3 Information about Factors Affecting to People's Participation in Mangrove Forest Management in Chanthaburi

The survey on the samples was to find factors that affect to people's participation in mangrove forest management in Chanthaburi by using the questionnaire invented by the researcher. The questionnaire consists of the set of questions about demographic attribute, namely age, education, knowledge and understanding about mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management. Additional set of questions consists of socio-economic characteristic, namely occupation, household income, and size of possessed land. The result is as shown in Table 4.4.

Table 4.4 Mean and standard deviation of factors affecting to people's participation in mangrove forest management in Chanthaburi

Important factors	Mean	Standard deviation	N = 288
1.Number of participation, awareness of the problem, planning, operation and evaluation of mangrove forest management per year (time)	2.68	2.26	288
2.Age (year)	42.78	12.83	288
3.Education level	-	-	288
4.Knowledge and understanding about mangrove forest management (score)	8.04	1.75	288
5.Period of settlement (year)	27.02	18.07	288
6.Social group membership (year)	3.54	3.51	288
7.Experience in mangrove forest management (time)	2.35	2.13	288
8.Occupation	-	-	288
9.Household income (Baht)	251,848.13	163,033.00	288
10.Size of possessed land (rai)	10.00	8.64	288

From Table 4.4, it was found that the number of time of people's participation in mangrove forest management in Chanthaburi in recent year from 288 samples were 2.68 times. The average area is 42.78 years. The average score of knowledge and understanding in mangrove forest management was 8.04 form total 10 scores. 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. The average household income was 251,848.13 Baht. And the average size of possessed land is 10.00 rai.

When considered on mean and standard deviation of independent variables or important variables and people's participation in mangrove forest management in Chanthaburi, it was found that standard deviation was lower than all average factors.

This reflects that there is no extreme value that causes the distribution to be problem for statistical analysis.

About the study on relationship of independent variables or important factors that affect dependent factors or people's participation in mangrove forest management in Chanthaburi, independent variables or important factors consist of 2 groups, including demographic independent variables, namely age, education, knowledge and understanding about 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 possessed land. It can be concluded as follows.

Independent Variables

1) Demographic independent variables

1.1 Age

1.2 Education

1.2.1 Primary education

1.2.2 Secondary education

1.2.3 Higher education

Create dummy variable from education level according to Hierarchical Regression analysis. Use higher education as basis for comparison. Two new variables are obtained.

1.2.4 edu 1……primary education: higher education

1.2.5 edu 2……secondary education: higher education

1.3 Knowledge and understanding of mangrove forest management (total know)

1.4 Period of settlement (located_period)

1.5 Social group membership (status_term)

1.6 Experience in mangrove forest management (ex-activities)

2) Socio-economic independent variables

2.1 Occupation

2.1.1 Fishery

2.1.2 Agriculture

2.1.3 Employee

2.1.4 Trading

2.1.5 Government officer

2.1.6 Others

Create dummy variable from occupation according to Hierarchical Regression analysis. Use fishery as basis for comparison. Consolidate government officer and others together to decrease the number of dummy variable. Four new variables are obtained.

2.1.7 occupa 1……agriculture: fishery

2.1.8 occupa 2……employee: fishery

2.1.9 occupa 3……trading: fishery

2.1.10 occupa 4……...others: fishery

2.2 Household income

2.3 Size of possessed land

Dependent Variable

Participation behavior in mangrove forest management of people in Chanthaburi

Table 4.5 Factors related to the number of time of people's participation behavior in mangrove forest management in Chanthaburi

Independent variables or important factors	Relationship on mangrove forest management (Pearson Correlation)	P (Sig.)
1.Age	0.004	0.221
2.Education		
2.1 Primary education (edu1)	-0.323	0.010**
2.2 Secondary education (edu2)	0.030	0.040**
3.Knowledge and understanding in mangrove forest management (total_know)	0.122	0.019**
4.Period of settlement (located_period)	-0.025	0.336
5.Social group membership (status_term)	0.118	0.022**
6.Experience in mangrove forest management (ex_activities)	0.412*	0.000**
7.Occupation		
7.1Agriculture (occupa1)	0.014	0.408
7.2Employee (occupa2)	-0.086	0.072
7.3Trading (occupa3)	-0.043	0.234
7.4Others (occupa4)	-0.086	0.073
8.Household income (h_income)	0.187	0.001**
9.Size of possessed land (area)	0.176	0.001**

Note: ** refers to statistical significance

From Table 4.5, it was found that independent variable or important factor was experience in mangrove forest management (ex_activities). Correlation of dependent factor or participation in mangrove forest management amount of participation was higher than 0.40. Other dependent factors or important factors

include household income (h_income), size of possessed land (area), primary education, knowledge and understanding about mangrove forest management (total_know), and social group membership (status_term). They had correlation with independent variable or participation in mangrove forest management close to 0.40 respectively. This shows linear relationship between independent variable or important factor and dependent factor or participation in mangrove forest management.

In the study on prediction power of independent variable or important factor on people's participation in mangrove forest management in Chanthaburi, independent variable or important factor is classified into 2 groups. They consist of demographic independent variables, namely age, education, knowledge and understanding of mangrove forest management, period of settlement, social group membership and experience in mangrove forest management, and eco-social independent variables, namely occupation, household income and size of possessed land.

From the study on prediction power, demographic independent variables or important factors include age, education, knowledge and understanding about mangrove forest management, period of settlement, social group membership, and experience in mangrove forest management. These influence people's participation in mangrove forest management in Chanthaburi. The results are shown in Table 4.6.

Table 4.6 Prediction power of important demographic factors on people's participation in mangrove forest management in Chanthaburi

Model.1	Unstandardized Coefficients		Standardized Coefficients	t	P (Sig.)
	B	Std.Error	Beta		
Constant	0.097	0.904		0.107	0.915
Age	0.005	0.012	0.030	0.436	0.663
Education					
Primary education (edu1)	-0.270	0.414	-0.059	-0.653	0.514
Secondary education (edu2)	0.137	0.393	0.030	0.349	0.727

Table 4.6 Prediction power of important demographic factors on people's participation in mangrove forest management in Chanthaburi (cont.)

Model.1	Unstandardized Coefficients		Standardized Coefficients	t	P (Sig.)
	B	Std.Error	Beta		
Knowledge and understanding of mangrove forest management (total know)	0.168	0.077	0.130	2.183	0.030**
Period of settlement (located_period)	-0.005	0.009	-0.037	-0.541	0.589
Social group membership (status_term)	0.067	0.039	0.103	1.727	0.085
Experience in mangrove forest management (ex_activities)	0.402	0.059	0.379	6.779	0.000**
Model.1: F= 9.692, P(Sig.)= 0.000, R^2= 0.195					

Dependent variable: amount of participation

From Table 4.6, it was found that forecasting equation, consisting of demographic factors (Model.1), was able to predict people's participation in mangrove forest management in Chanthaburi at significance level of 0.05 (F= 9.692, P(Sig.) = 0.000) and prediction power 19.50%.

When considered on each variable from 7 independent factors, it was found that 2 independent factors with influence on people's participation in mangrove forest management in Chanthaburi at significance level of 0.05 were knowledge and understanding in mangrove forest management (Beta=0.130) and experience in mangrove forest management (Beta=0.379) respectively.

About the study on prediction power, socio-economic independent variables or important factors include occupation, household income and size of possessed land. They had influence on people's participation in mangrove forest management in Chanthaburi. The results are shown in Table 4.7.

Table 4.7 Prediction power of important socio-economic factors that influence people's participation in mangrove forest management in Chanthaburi

Model.2	Unstandardized Coefficients		Standardized Coefficients	T	P (Sig.)
	B	Std.Error	Beta		
Constant	2.054	0.366		5.611	0.000
Occupation					
Agriculture	-0.292	0.335	-0.060	-0.871	0.385
(occupa1)	-0.107	0.403	-0.019	-0.266	0.790
Employee (occupa2)	-0.407	0.561	-0.045	-0.726	0.469
Trading (occupa3)	-1.174	0.690	-0.104	-1.703	0.090
Others (occupa4)					
Household income (h_income)	0.021	0.010	0.149	2.154	0.032 **
Size of possessed land (area)	0.029	0.019	0.111	1.555	0.121
Model.2: F = 2.946, P(Sig.) = 0.008, R^2 = 0.059					

Dependent variable: amount of participation

From Table 4.7, it was found that forecasting equation consisted of socio-economic factors (Model.2). They are able to predict people's participation in mangrove forest management in Chanthaburi at significance level of 0.05 (F= 2.946, P(Sig.) = 0.008). However, prediction power is only 5.90%.

When considered each variable from 6 independent factors, it was found that only one independent factor had the influence on people's participation in mangrove forest management in Chanthaburi at significance level at 0.05. It was household income (Beta= 0.149).

About the study on prediction power of independent variables or important factors that had influence on people's participation in mangrove forest management in Chanthaburi, 2 groups of independent variables or important factors consisted of demographic independent variables, namely age, education, knowledge and

understanding about 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 possessed land. The results are shown in Table 4.8.

Table 4.8 Prediction power of important demographic and socio-economic factors that influence people's participation in mangrove forest management in Chanthaburi

Full Model	Unstandardized Coefficients		Standardized Coefficients	T	P (Sig.)
	B	Std.Error	Beta		
Constant	0.187	0.993		0.188	0.851
1. Age	0.004	0.013	0.021	0.294	0.769
Education					
2. Primary education (edu1)	-0.323	0.446	-0.071	-0.725	0.469
3. Secondary education (edu2)	0.030	0.422	0.007	0.070	0.944
4. Knowledge and understanding about mangrove forest management (total know)	0.169	0.078	0.130	2.175	0.030**
5. Period of settlement (located_period)	-0.004	0.009	-0.032	-0.454	0.650
6. Social group membership (status_term)	0.041	0.040	0.064	1.045	0.297
7. Experience in mangrove forest management (ex_activities)	0.382	0.060	0.359	6.355	0.000**
Occupation					
8. Agriculture (occupa1)	-0.240	0.319	-0.049	-0.751	0.453
9. Employee (occupa2)	-0.308	0.380	-0.055	-0.810	0.419
10.Trading (occupa3)	-0.380	0.529	-0.042	-0.718	0.474
11.Others (occupa4)	-1.268	0.692	-0.112	-1.831	0.068

Table 4.8 Prediction power of important demographic and socio-economic factors that influence people's participation in mangrove forest management in Chanthaburi (cont.)

Full Model	Unstandardized Coefficients		Standardized Coefficients	T	P (Sig.)
	B	Std.Error	Beta		
12. Household income (h_income)	0.011	0.009	0.077	1.164	0.245
13. Size of possessed land (area)	0.011	0.018	0.043	0.620	0.535
Full Model.: F= 5.942, P(Sig.)= 0.000, R^2= 0.219					

Dependent variable: amount of participation

From Table 4.8, it was found that forecasting equation, which consisted of demographic and socio-economic factors (Full Model) able to predict people's participation in mangrove forest management in Chanthaburi at significance level of 0.05 (F= 5.942, P(Sig.) = 0.000). Prediction power was 21.90%.

When considered each variable form 13 factors, it was found that 2 independent factors had the influence on people's participation in mangrove forest management in Chanthaburi at significance level of 0.05. They were knowledge and understanding about mangrove forest management (Beta = 0.130) and experience in mangrove forest management (Beta = 0.359) respectively.

In comparison of the first model (model.1), demographic independent factors include are, 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 include occupation, household income, and size of possessed land. The third model (full model.) consists of demographic and socio-economic independent factors. In each model, independent factors are able to predict people's participation in mangrove forest management in Chanthabuti at significance level of 0.05. The third model (full model.) has the highest prediction power at 21.90%. This is better than the first model (model.1) 2.40% and better than the second model (model.2) 16%.

In addition, one interesting factor was found, household income (h_income). If it is in the group of socio-economic independent factors, it will have influence on people's participation in mangrove forest management in Chanthaburi at significance level of 0.05. However, when both characteristics are combined to predict people's participation in mangrove forest management in Chanthaburi, it was found that household income (h_income) had no influence on people's participation in mangrove forest management in Chanthaburi.

From comparison on each model, the best model was attained for prediction of people's participation in mangrove forest management in Chanthaburi, the third model (full model.). It has coefficient in raw score form. It consists of constant coefficient 0.187, age coefficient 0.004, primary education coefficient (edu1) -0.323, secondary education coefficient (edu2) 0.030, coefficient of knowledge and understanding in mangrove forest management (totalknow) 0.169, coefficient of period of settlement (located_period_ -0.004, coefficient of social group membership (status_term) 0.041, coefficient of experience in mangrove forest management (ex_activities) 0.382, coefficient of agricultural occupation (occupal) -0.240, employee coefficient (occupa2) -0.308, trading coefficient (occupa3) -0.380, coefficient of other occupations (occupa4) -1.268, household income coefficient (h_income) 0.011 and coefficient of size of possessed land (area) 0.011. Forecasting equation can 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 + 0.030*secondary education edu2 + 0.169*knowledge and understanding in mangrove forest management totalknow - 0.004*period of settlement located_period + 0.041*social group membership status_term + 0.382*experience in mangrove forest management ex_activities - 0.240*agricultural occupation occupa1 - 0.308*employee occupa2 - 0.380*trading occupa3 - 1.268*other occupation occupa4 + 0.011*household income h_income + 0.011*size of possessed land area.

In conclusion from the study on primary information, it was found that knowledge and understanding about mangrove forest management and experience in mangrove forest management are important factors that affect to people's participation in mangrove forest management in eastern coastal provinces of Thailand. Most people

have knowledge and understanding about mangrove forest management at medium level. They have experience in mangrove forest management 2.35 times per year on the average.

4.2 Results from Environmental Education Process

Environmental education process presents 3 aspects of the information as follows.

4.2.1 Successful environmental education model for mangrove forest management

4.2.2 Other special factors and conditions that support the project or institute in successful mangrove forest management

4.2.3 Environmental education model for mangrove forest management appropriate for eastern coast of Thailand

4.2.1 Environmental Education Model for Successful Mangrove Forest Management The study on environmental education model for successful mangrove forest management is an analysis of environmental education used in successful project or institute. It is obtained from in-depth interview with the executive of the project or institute, which is specifically chosen (purposive sampling) according to the criterion identified in the process. These consist of:

1) Khungkraben bay royal development study center project, Chanthaburi
2) 2nd mangrove forest resource development station (Tasorn, Chanthaburi)
3) 3rd mangrove forest resource development station (Klung, Chanthaburi)
4) Banprednai community in Huangnamkhao subdistrict, Muang district, Trat

From the study, Khungkraben bay royal development study center project, Chanthaburi, was established by the king's idea. His majesty assigned Chanthaburi to find deteriorated area or public area in order to establish coastal research and development center. It would study, demonstrate, and develop coastal areas and apply knowledge integration method from many institutes in development plan and resource

management. Khungkraben bay royal development study center project, Chanthaburi, is located at mu.4, Klongkud subdistrict, Tamai district, Chanthaburi. Its operational area is separated into 2 parts, including operating area and result-extended area, covering 33 villages in Klongkud subdistrict, Ramphan subdistrict, Tamai district, and Sanamchai subdistrict, Krajae subdistrict, Nayaarm district, Chanthaburi. It occupies about 71,025 rai of the land. It has population 19,886 persons approximately and the number of households is 6,185.

From the operation in mangrove forest management of Khungkraben bay royal development study center project, it was very successful, especially in operating area. A lot more of mangroves have been grown and there is systematic management. It was elevated as the national model of mangrove forest management. Regarding to this, villagers' knowledge and understanding were increased for behavioral adjustment, which is positive for mangrove forest. In other words, it is environmental education (Tawee Jindamaikul, 2011).

At the same time, there was the study on mangrove forest development of 2nd mangrove forest resource development station (Tasorn, Chanthaburi) under the Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment. Most entrusted areas are in Waeru basin national park, covering 2 subdistricts. Those include 6 villages in Bor subdistrict, namely mu.1, mu.2, mu.3, mu.4, mu.5, mu.7 and 2 villages in Bangchan subdistrict, namely mu.2, mu.4. Entrusted area occupies 12,000 rai approximately. The number of population in entrusted area is 5,764 persons. The number of households is 1,900.

From previous results, it was found that 2nd mangrove forest resource development station (Tasorn, Chanthaburi) was successful according to the goal determined by the institute. The most obvious result is the increase of mangrove forest area in entrusted area and being learning center and study trip source about mangrove forest management for other institutes. Such success mostly comes from teaching the people through the meeting and seminar to change their behavior on mangrove forest management or mangrove forest conservation. In other words, environmental education was applied for the operation (Namfon Petchkham, 2011).

In addition, the researcher studied about mangrove forest management of 3rd mangrove forest resource development station (Klung, Chanthaburi) under Department of Marine and Coastal Resources, Ministry of Natural and Environmental Resources. It has entrusted area covering 2 districts. Those include 4 subdistricts in Klung district, namely mu.1, mu.3, mu.4, mu.6, mu.7, mu.8 in Wanyao subdistrict, mu.5, mu.8, mu.10 in Kweanhak subdistrict, mu.1, mu.2 in Tapon subdistrict, mu.2, mu.3, mu.4, mu.5, mu.6 in Bangchan. About another district, Lamsing, it has 2 subdistrict, namely mu.7, mu.8, mu.9, mu.10 in Nhongchim subdistrict, and mu.4, mu.6, and mu.7 in Korpred subdistrict, totally 23 villages. Entrusted area covers 10,000 rai approximately. The number of population living in the area is 13,449 persons and 4,537 households.

About the results of 3rd mangrove forest resource development station (Klung, Chanthaburi), it was successful in mangrove forest management. The amount of mangrove forest area increased according to expectation. And invasion of mangrove forest highly decreased. At the same time, entrusted area became learning source for university students regarding to mangrove forest management. In the operation of mangrove forest management, environmental education was applied as a major strategy for the institute (Winai Boonlom, 2011).

In the study on successful environmental education model in mangrove forest management, the study was also conducted in Banprednai community, Huangnamkhao subdistrict, Muang district, Trat. From the study, it was found that Banprednai community was in mu.2. It had population 630 persons in 220 households (in December 2010). The eastern part of the village was adjacent to Trat bay. The village had entrusted mangrove forest area about 12,000 rai. Most people were farmers, including gardening and fishery. Most plants were fruits, such as durian, mangosteen, and rambutan. About fishery, they do native fishery, such as catching fishes in canals, catching sea crabs, doing natural prawn farm.

About mangrove forest management, Banprednai community reflected the strength and potential of the community in taking care of 12,000 rai or mangrove forest. They have management system that allows people to participate and use the environment to teach people. This leads to the change of people's behavior on mangrove forest. Banprednai community is appreciated by global stage. Its mangrove

forest was ranked as 20th fertile ecology of the world and 2nd place of Thailand. Moreover, Banprednai is also learning source about mangrove forest ecology for many domestic and foreign institutes. It also won green globe award in 1999 (Amporn Patsard, 2011).

From all 4 projects or institutes mentioned above, they are considered successful projects or institutes in mangrove forest management. Importantly, all 4 projects or institutes applied environmental education for mangrove forest management. From in-depth interview with responsible persons or the people related to the projects or institutes regarding to environmental education model, it was found that:

Applied environmental education model consisted of 3 models, including environmental education integrated into formal education curriculum, such as sciences, social studies, religious and culture, hygiene, and physical education. However, most environmental education regarding to mangrove forest is the course added in the curriculum. The school or academic institute will manage in inviting the persons or representatives of the institute, who know about mangrove forest, to teach and talk about their experiences to the students. The second environmental education model is outside of formal education. Target schools participate in the activity by emphasizing on teaching the public. The moderator or expert disseminate through various media. It has a clear process with scheduled procedure, such meeting, training, seminar, and camping. The third environmental education is outside formal education. The people or target group do not participate its activity. It applies various media. The content aims to teach the audience about mangrove forest in order to lead to good behavior in mangrove forest management, such as publications and websites.

From in-depth interview with prof. Tawee Jindamaikul (2011), he mentioned about environmental education model of Khungkraben bay royal development study center project as environmental education model for mangrove forest management currently used by Khungkraben bay royal development study center project teaches the people about many occurring cases. It ranges from environmental or natural cases, such as riverside erosion, climate, and villagers, who cause the impact to the environment by deforesting for agricultural purpose, residence, and to earn income. Teaching about both cases of environmental situations, namely natural and human actions, which negatively impact the community, consists of 3 main forms:

1) Teach the individual through conversation, meeting, discussion, festival, and social activities in the community or informal education.

2) Teach the individual and the group through meeting, training, seminar, which is formal education.

3) Teach the public through mass media, such as radio, television, internet, broadcasting, which is non-formal education.

Environmental education for mangrove forest management has been applied by using participatory technique in every step. It consists of mutual learning and experience exchange between the officers and the people, finding for solution together, cooperating and controlling the work for substantial and practical mangrove forest management.

At the same time, 2nd mangrove forest resource development station (Tasorn, Chanthaburi) also applied 3 major environmental education models for mangrove forest management. From in-depth interview with institute academician, Miss Namfon Petchkham (2011) stated that the method or model used by the institute for mangrove forest conservation or management could cause income for villagers by mainly emphasizing on ecological tourism business. However, it aims at participation of villagers or local people in every step of management of activity. This also includes the establishment of community enterprise supported by other government institutes until it was able to conduct activities effectively, leading to stable community economy. Almost all activities rely mainly on workshop and training to teach and communicate in the operation.

Another method used by the institute was inviting villager to the meeting to teach about the importance of mangrove forest and living with mangrove forest without deforestation. This includes earning additional income from fishery, which previously originated from mangrove forest.

Another method that is successful for mangrove forest management is convincing community leaders to attend mangrove forest management activity or allowing them to experience in conservation by using workshop as the main activity of the process. After that, the leaders will carry on or extend the results among their group members though discussion or informal education process. 2nd mangrove forest resource development station (Tasorn, Chanthaburi) emphasizes on continuous

meeting with the leaders in formal and informal ways. It convinces the group to realize the benefits of community mangrove forest. About Bor subdistrict and its neighborhood, they have been foresting for 4-5 years. The results form forestation and benefits of restored mangrove forest appear to the community. For example, in the past 5-6 years, there were so many prawn farms but the price was low. There was widespread of pandemic disease. There was gentrification for prawn farming until mangrove forest ecology was lost. This considerably decreased the number of coastal aquatic animals. Therefore, fishermen and villagers, who depended on coastal aquatic animal as food source, catch less aquatic animals. However, when mangrove forest becomes more fertile, their aquatic animals, their food source and income, have returned. Thus, the leaders and community cooperate more in mangrove forest management.

Another method is increasing community's income through ecological tourism by allowing tourists to sightsee fishermen lifestyle in the village and many kinds of hawks in mangrove forest. At the same time, the tourists can directly buy products from villagers' fishery without depending on the middlemen. These directly cause income for the community due to having mangrove forest. Coastal fishermen or sea fishermen are also able to earn income from tourism by taking the tourists to sightsee the see and the coast. They will earn wage for this. About this method, the meeting and discussion were used as important activities to teach and assemble of ecological tourism.

In addition, activities were arranged to meet the public and exchange experiences together. Public relation team was sent to visit communities. They usually traveled by boat since their assigned areas were sea and islands. Moreover, there were village's monthly meetings with other institutes. They went to teach about benefits of mangrove forest. They also publicized, arranged exhibition, and teach about mangrove forest in government organizations, such schools, subdistrict administrative organization, and municipality. About characteristic of the operation in teaching and maintaining mangrove forest, responsibility is assigned to 2 teams, including advertising team, which teach about mangrove forest management or conservation, and surveillance team, which prosecutes the culprits regarding to mangrove forest. Important activities are patrolling around mangrove forest to prevent invasion and

forestation and advertising to teach the people about mangrove forest conservation. They are responsible for both sea and land. Both teams usually perform the operation twice a week. They also perform other operations if any.

Another institute, which was successful in mangrove forest management, was 3rd mangrove forest resource development station (Klung, Chanthaburi). They applied environmental education to adjust local people's behavior to participate in mangrove forest conservation. From in-depth interview, Mr.Winai Boonlom (2011), the head of 3rd mangrove forest resource development, stated that the measure or environmental education model used for mangrove forest conservation or management can be separated into 2 models.

1. Mangrove forest management or conservation according to government policy and original affiliation can be separated into 2 main topics, including:

1.1 Mangrove forest management model that emphasizes on prevention and suppression of invasion into mangrove forest. Its strictness is in accordance with rules and legal regulations. In the operation, primary knowledge must be disseminated. About scope of operation, the area is strictly prohibited for utilization, period, characteristic and legal proceeding. Mass media are mainly used for communication, such as broadcasting station, community radio, cable television, and other media that cover local people. Strict operation considerably affects the people. It also directly affects to officers' operation in local area. Although some of them consider that following clear regulation is not difficult, in fact, it is not easy like that. Strict operation sometimes directly affects to the people. It might make them frustrated or troubled, which will lead to future problems.

1.2 Mangrove forest management model that emphasizes on mangrove forest conservation increases villagers' knowledge and understanding about benefits of mangrove forest on the community. It makes the villagers to live in harmony with the forest according to the king's speech. To live with the forest, villagers must participate with government institutes according to the constitution through environmental education activities mainly consisted of workshop, training and seminar. 3rd mangrove forest resource development station (Klung, Chanthaburi) participated in every sector in mangrove forest management. Many sectors obtained benefits from mangrove forest together. Although they were some conflicts with the

regulations, there was good response from the community. It was possible to establish the network or the group that participated in the operation of mangrove forest conservation with responsible institute. This increased the amount of mangrove forest area, which was better than enforcing the law. Strict administration according to the law in certain period might causes resistance from the people, who lose their profits. This hinders the officers from operating effectively.

The promotion of mangrove forest management aims to use gentle method by taking and teaching local people. This important part allows the institutes and officers to work at their full capacity. However, they sometimes have to avoid or violate the regulation. The community must realize that their violation is illegal and they should not do it.

2. Mangrove forest management or conservation model builds good social relationship. It is another model of informal environmental education, which relies on meeting with the public or participants of social activities, such as ordination ceremony, wedding ceremony, and funeral in the village. The head and officers of the institute attended those mentioned activities regularly. Attending social activities builds good relationship between the institute and community. They have opportunity to talk and exchange their attitudes and opinions about mangrove forest management. Mangrove forest resource development station has become part of community lifestyle. These support the procedures we communicated with the community. We are able to be harmonious with community lifestyle without causing undesirable conflict. This mangrove forest management model offers permanency in the operation. The importance of managerial model in harmonious with the community is the establishment of network, which takes a long time to complete.

Community sector was also very successful in mangrove forest management, especially in Banprednai community, mu.2, Huangnamkhao subdistrict, Muang district, Trat. It was found that all 3 environmental education models were applied, including formal environmental education, non-formal environmental education, and self-learning environmental education in mangrove forest management. From the interview with Mr.Amporn Patsart (2011), he stated about environmental education and mangrove forest management as Banprednai mangrove forest conservation group was established from community research through workshop and

community meeting. Before we established conservation group, we asked the community whether they agree with the establishment of mangrove forest conservation or management or not. It appeared that more than 80-90% of villagers agreed with group establishment. So we formed the group. We did not recruit new members but we allow most people, who agreed, to become members of mangrove forest conservation group. The group covered every family in mu.2 Banprednai. We have principle for forming the group. The group must have its regulation in using the resources. We allowed all families and organizations in mu.2 Banprednai, including housewives' group, youth group, elder group, and cultivation group to designate their representatives, one for each group, to work as committees in determining club regulation when we have 19 committees from all 19 organizations in the village. Rule or regulation from workshop or community meeting was applied to change villagers' behavior for mangrove forest conservation or management. After villager's regulation has been outlined, it will be sent to all households in the village to check if they can accept it. After that, they will hold a meeting for final resolution, such as unacceptable rule, additional rule, and revised rule. When all families come to meet and they agree, nobody reject, we announce this regulation to be the village's rule. There is punishment for violation. Restoration regulation is considered from the actual condition of the area to restore deteriorated matters. Forestation was determined to carry on annually. They will reforest until there is no place to grow. There is mangrove forest surveillance and restoration. Restoration aims at what used to be abundant when 12,000 rai of mangrove forest existed and they disappeared after mangrove forest was destroyed. The community studies the information of the impact on community together. They use people's experiences to find solution. The determination of community's mangrove forest management is similar to research. Later, this research has become community's regulation for mangrove forest management. Collective learning, which is similar to village's research, is derived from the people that collect stuffs in mangrove forest. They hold a meeting monthly. The elders educate, especially about sea crab's laying. It is well known that during low tide in October, sea crabs will lay eggs. They will come out to lay eggs on riverbank. That is the nature. The collectors always notice this. Knowledge about mangrove forest is passed on from village elders because it is local intellect.

From such study, it was found that environmental education used for mangrove forest management by 3 institutes and 1 community can be classified into 3 types, including formal environmental education, non-formal environmental education, and self-learning environmental education. All 3 institutes and 1 community integrated it for mangrove forest management.

Environmental education model used for mangrove forest management by successful institutes or projects consisted of 3 types, which were integrated in the operation. However, the best model in the study is non-formal type, which applies advanced media and technologies. The instructors or experts are quality. And they allow the people or participants to participate the activity. The most important activity of this environmental education model is workshop.

"About the most appropriate or most effective environmental education model for mangrove forest management of Khungkraben bay royal development study center project is environmental education that applies workshop process to teach about mangrove forest management, allows participation, and offers experience to participants. The activities contained in environmental education model are based on former lifestyle of the community. They are not oppose to villagers' culture in missing part or needed by the community. It opens an opportunity for the people to participate in the activity widely without forcing. The activities are not complex. There is no need for high level of knowledge. The villagers are able to do on their own. It also includes the combination between theories and local intellect. Policies or practices are conveyed to the people in top-down form, which is forcing them to do. It cannot cause permanency because it is not the people's need." (Tawee Jindamaikul, 2011)

"The best and most appropriate mangrove forest conservation model used in assigned area by the institute is participatory operation of public sector. It focuses on teaching the people through workshop and other forms of meeting regarding to benefits from mangrove forest they will receive. For instance, tourism business makes better income than deforestation. This includes the recovery of aquatic animal resource. Mangrove forest management or conservation by people's participation is more permanent than other methods. Participation characteristic is collective thinking, action, investment, and evaluation. In conservative tourism business, for example, we will invite the leaders, namely community leaders, knowledgeable villagers, and

natural leaders to brainstorm for mangrove forest management method that allows the people to use mangrove forest without the need to destroy it. Finally, mangrove forest ecological tourism is attained. After that, there was an activity arranged by the community and our institute called “Firefly festival on walking street”. This fair becomes recognized across the country. Activities in the fair are communicated through community leaders to community members, such as selling the products produced by the community and surrounding area. Activity participants might be chosen or visit personally. They are producers with interesting products. Our center might choose them. And there are many other groups. However, we must give precedence to the leaders, who gather the people to attend the activity. Our institute is only a consultant for the operation.

Important reasons that mangrove forest management with people’s participation and harmonious living between human and the forest through workshop is successful model are people’s knowledge and realization on benefits of mangrove forest and reward from fertile forest. The forest is the source of income and natural food source. These were lost corresponding to the decrease of mangrove forest area. One important supportive method is that we conducted to teach villagers in conserved forest area by using village meeting to inform important details, such as employing the residents to grow forest and take care of those trees. We did not keep them out of the area because they have settled in that area long enough. The residents in conserved forest area are allowed to do prawn and crab farms. Later, prawn farms had many problems, including epidemic, low price, and expensive feed. Many areas prepared for prawn breeding were abandoned. At the same time, reforestation project in deteriorated and abandoned areas were seriously supported. The villagers also cooperated with the project fully because they receive many profits from this project, such as wage for growing, the trees they use in their daily life, food source and income from the forest they grew.” (Namphon Petchkham, 2011)

“The best environmental education model or people’s behavior adjustment process for mangrove forest management of 2nd mangrove forest resource development station (Klung, Chanthaburi) is teaching the community about mangrove forest comprehensively through informative conference and informal meeting in community’s important activities. Currently, most violation about mangrove forest

invasion is caused by ignorance in legal regulation and practice for mangrove forest. For example, they do not know about national conserved forest line since the detail might be too difficult.

Important reason of being the best model of the institute is because the method is practical and it has the least conflict with the people. The notice we found in the operation in enforcing the laws related to mangrove forest is that 3-4 cabinet resolutions assigned to the officers mostly originated from resistance of local people related to mangrove forest, for instance, prohibition in mangrove forest area utilization in accordance with Act of National Park. Later, cabinet resolution was issued to delay in arresting people, who utilize mangrove forest, due to wide resistance of them." (Winai Boonlom, 2011)

"The best model to make the community successful in mangrove forest management is community meeting because the meeting allows its members to participate in thinking, making decision, carrying on, and take responsibility together. When we have formed conservative group, we collectively set mutual agreement that we need rules and regulations for resource utilization, punishment, restoration, and development for permanency and capability to make money for the community. The committee, consisting of 19 persons, was established to outline the rules or regulations. We took years to outline this rule because we returned each item to all families to consider whether they can take it or not. Then we return it to the committee to consider again and revise some points. After that, we held community meeting to find resolution for community regulation. Finally, when the regulation was acceptable for all village members, it was announced.

Community meeting has one crucial advantage. It increases knowledge and understanding for all relevant sides, which leads to acceptance in community rule. Everyone will respect the rule. They will not violate mutual agreement. In the process of community rule or regulation announcement, many government officials and high rank provincial executives came to witness. In addition, such regulation was advised by the sheriff, district forestry department, and other knowledgeable persons. There is no objection against this community regulation because it has been through discussions and resolutions during the process. There were community meetings to find solution regarding to all details and main topics." (Amporn Patsart, 2011)

From such study, it can be concluded that workshop is the process to teach, brainstorm, work as a team, encourage, and empower people's cooperation. It also takes little time and budget but gives good conclusion. This is the most appropriate activity for mangrove forest management, which is classified as non-formal environmental education.

Another important thing that must be in environmental education model for mangrove forest management is model composition or environmental education model. It consists of objectives and policies in mangrove forest management, aim, content, format and structure, purpose of environmental education, activity strategy and evaluation. From the study, it was found that environmental education model of both institutes, 1 project in royal idea, and 1 community applied environmental education model with compositions mentioned above.

"Important composition of environmental education for mangrove forest management consists of 3 major compositions.

1. Objective or global result needed to happen to the people after they have attended all activities or have completed environmental education process. Such global result can be easily acknowledged by the people and beneficial for the community.

2. Activity process or activity strategy is appropriate and it has criterion. The activity opens an opportunity for the people to participate or possess mangrove forest management project for experience creation as well as creating awareness of participants.

3. The content is able to communicate to the participants to realize clear trouble condition, solution, and the current achievement. This is important point in causing skills and abilities to solve mangrove forest problem." (Tawee Jindamaikul, 2011).

At the same time, study result from 2nd mangrove forest resource development station (Tasorn, Chanthaburi) showed that compositions of environmental education for mangrove forest management consist of activity that open opportunity for the people to participate, purpose, target group, government policy, type of media and content of mangrove forest management obtained from interview with academician at 2nd mangrove forest resource development station (Tasorn,

Chanthaburi). “Important composition of environmental education model for participatory mangrove forest management is the process in conservation or management that allows the people to participate in every step more than other models. It also involves the objective of mangrove forest management whether how we set the objective of mangrove forest management. Is it in accordance with government policy, and how? Following government policy is simple in the operation. It is considered as external opportunity that helps the work successful.

In addition, the determination of target group is important for the operation. It can be separated into 2 groups, including people and students. Both groups have different important factors in learning. For obvious example, students are suitable for formal education but general people is suitable for learning through media around them, such as radio, broadcasting station, conference, and meeting. The most important thing is learning content. It emphasizes on teaching about the benefits of mangrove forest, rules and regulations of mangrove forest, which has been announced as national park. Correct false belief in the word that the forest is captured by the government but bare land can be possessed. They look at title deed of deteriorated forest. From previous proceeding, our station taught about correct understanding in this topic to the people continuously. We also assure them that they will not be pushed out from their land, which is announced as national park. In addition, trustworthiness between the community and the officers, who directly affect to the community, was built.” (Namphon Petchkham, 2011).

Furthermore, the researcher studied about important compositions of environmental education for mangrove forest management from 3rd mangrove forest resource development station (Klung, Chanthaburi). Such institute applied it effectively and efficiently. It has important compositions as follows. The content and government policy needed to be conveyed to the target group. From in-depth interview with the head of 3rd mangrove forest resource development station (Klung, Chanthaburi), “ Important compositions of environmental education model for mangrove forest conservation or management used in assigned area is the matter of mangrove forest that functions or benefits to the community as the source of basic needs for the people living in mangrove forest. This is increasingly crucial because we always involve with economy and cost of living. Aquatic animals, which are natural

source of income of people in mangrove forest, are decreasing according to remaining mangrove forest area. How do these phenomena occur? We will reflect this to the people. For initial answer, it can be understood that it is because mangrove forest. But the deeper answer must be thought over by oneself for better recognition. However, to speak of government policy about mangrove forest conservation, it is feasible." (Winai Boonlom, 2011)

From the study on compositions of environmental education model for mangrove forest management, 3 successful institutes, including 2 government institutes and 1 project in royal idea were studied. The study in the latest organization was conducted at community level. It was Banprednai community in mu.2, Huangnamkhao subdistrict, Muang district, Trat. It was found that environmental education model for mangrove forest management of the community had these following important compositions, namely main point, government policy, objective of environmental education, activity procedure, and target group. With in-depth interview with the president of Banprednai mangrove forest conservation group in mu.3, Huangnamkhao subdistrict, " Important compositions of environmental education model or the method used here to change people's behavior for mangrove forest management is the main point of rules or regulations determined by the community through the community's consideration, and enforced by the community. Affected persons or collectors and interested persons must acknowledge this rule. The obvious matters of Banprednai community's regulation consist of maintaining the forest for natural habitat of aquatic animals, using it for community's living, and reserving it as the world's heritage. In addition, the objective was determined that we will keep mangrove forest for our descendants to live with. Moreover, we also consider on government policy, such as Department of Forestry. This is because regulation must refer to legal principle." (Amporn Patsart, 2011)

In conclusion, important compositions of environmental education model for mangrove forest management consists of mangrove forest mangrove objective and policy, content, objective of environmental education activity, activity strategy and evaluation. The main point is very important composition because it can teach the people, leading to the change of their behavior positively to mangrove forest, which affects to mangrove forest management.

From the study on good or successful environmental education model for mangrove forest management and important compositions of environmental model though analysis of environmental model used in successful project or institute, good environmental education model for mangrove forest management was obtained. It was workshop-informal environmental education model, consisting of these following compositions, namely the main point, objective and government policy about mangrove forest, objective of environmental education, objective of environmental education activity, activity strategy, and evaluation.

<table>
<tr><td rowspan="2">Workshop</td><td colspan="3">Content of main point of mangrove forest management</td><td rowspan="2">Workshop</td></tr>
<tr><td>Goal of workshop with mangrove forest management</td><td>Objective of workshop for mangrove forest management</td><td>Purpose and mangrove forest management policy of the government</td></tr>
<tr><td colspan="5">Workshop</td></tr>
<tr><td colspan="5">Results from workshop</td></tr>
<tr><td colspan="5">Evaluation</td></tr>
</table>

Figure 4.1 Successful Environmental Education Model for Mangrove Forest Management

4.2.2 Other Special Factors and Conditions That Promote or Support The project or The Institute to Accomplish Mangrove Forest Management

The study on other special factors and conditions that promote or support the project or the institute in successful mangrove forest management is an analysis on other factors and conditions that contribute to the success of the institute. In-depth interview was conducted with the executives of specifically-selected projects or institutes (purposive sampling) according to the criterion determined in study process, consisting of:

1) Khungkraben bay royal development study center project, Chanthaburi

2) 2nd mangrove forest resource development station (Tasorn, Chanthaburi)

3) 3rd mangrove forest resource development station (Klung, Chanthaburi)

4) Banprednai community, Huangnamkhao subdistrict, Muang district, Trat.

From the study on 4 projects, there were other special factors and conditions that promoted or supported the use of environmental education for mangrove forest management contributing to the success of mangrove forest management of the projects or institutes. In-depth interview was directly conducted with the people in charge or involved with the project to study about other special factors and conditions. The main special factors and conditions consist of participation in every process of mangrove forest management of the people or the community, direct income or profit the community receives after the implementation of mangrove forest management, good relationship between practitioners and the community, strictness according to legal regulation, source of capital and budget beside from normal allocation, good leadership of project leader, the leader group or community is strong in conducting community activities, acceptance of the community on the projects or institutes due to their benefits for the social, solution for the community, support from local administrative organization and other local institutes, and finally, solution of the project or institute to reduce obstacles in mangrove forest management. Each project or institute has their special factors or conditions and solution as follows.

“ Other conditions and factors that affect to mangrove forest management of Khungkraben bay royal development study center project, Chanthaburi consist of:

1. Allow the community to participate in every procedure, namely thinking, doing, investing, and assessing in mangrove forest management in community area for optimal benefit and fair for everyone in the community.

2. Being the project in royal idea, which Thai people know as the king Bhumibol’s non-profit project for the public, makes all Thai people participate in the operation willingly.

3. Global trend aims to conserve natural resources, especially forest, in order to alleviate global warming and the cause of disasters from natural resources destruction.

4. Support from local administrative organizations and other local institutes, namely temples, schools, public health center, and police station.

5. Increase the income for community and people related to mangrove forest, especially in Khungkraben bay royal development study center project. Arrange ecological tourism activities, which were considerably successful and became the model for many areas in the country.

Problems and obstacles in mangrove forest management operation of Kungkraben bay research and development center consist of:

1. Personnel problem: The number of personnel is considered limited comparing to assigned areas and tasks. For the solution, Khungkraben bay royal development study center project coordinates with other institutes to request for support of expert personnel in specific cases.

2. Frequent shift of personnel in the operation causes discontinuity in certain activities. For solution to this problem, Khungkraben bay royal development study center project invented operation guideline or task schedule in order to decrease working problems of newly designated officers.

3. There is little growing opportunity of position and responsibility for personnel in the line of Khungkraben bay royal development study center project. This involves with less income earned for family's cost of living. Therefore, each officer bears heavy burden to support their families. To solve this problem, Khungkraben bay royal development study center project aims to develop the potential of all officers to be specialized in particular field so that they can earn more income." (Tawee Jindamaikul, 2011)

Another institute, which studied on other factors and conditions that affect to mangrove forest management beside from environmental education model for mangrove forest management conducted in assigned areas by the institute, is 2nd mangrove forest resource development station (Tasorn, Chanthaburi). From in-depth interview with the person directly related to the project, he stated about other factors and conditions, "Other conditions or factors that contribute to the success of mangrove forest management are basically allowing the people or community to participate in management of community's own valuable resources. It also creates consciousness of

possession in the community. In addition, it is leadership with capacity in organizational operation. The head of the station is competent. He is well-known and respected by general people. He knows about capital source and he has good technique in gathering the fund to develop mangrove forest management, particularly in developing his own organization to become capable of mangrove forest conservation propulsion. For instance, in 2005, 3rd mangrove forest resource development station (Tasorn, Chanthaburi) had only one office. However, in a few years ago when the chief came to work here, the institute has considerably changed, including the building, public utilities, and technologies. About development of human resources, which live in assigned mangrove forest area, the national park, are uneducated due to the lack of money. They are ordered to sell goods or work in the station. Unemployed youths are in the focus. Moreover, capital sources were seek and gathered successfully. The fund was fully used to arrange activities for mangrove forest management. It was also used to support the establishment and operation of community enterprise, which made money for participants in mangrove forest management, to motivate the people. Strong community leaders, who supported mangrove forest management, contributed to the success of the station in its operation. This is because personal relationship of community leaders and local organizations and heads of the institutes. About the problems and obstacles, the operations in the islands are not cooperated by the residents because they are afraid of legal proceeding that they must leave their land. Moreover, personnel are insufficient, namely patrolling and surveillance manpower, and the guide to lead the tourists to sightsee the nature of mangrove forest in the station area. About the solution regarding to manpower, relevant tasks are integrated and the existing manpower is utilized effectively. It aims to allow the people to participate fully. About conflict between the institute and the community, local people are allowed to work on their own. Government officers support and take care of them according to government policy and the law. This includes procedural proceeding from light to severe punishment, starting from warning. If one does not stop legal violation or mangrove forest invasion, more severe proceeding will be carried on respectively. In addition, community measure is also applied to prevent mangrove forest invasion. The information of culprits is coordinated among responsible community leaders regarding to crime scene and

hometown of the culprit. About the solution for budget used for patrolling and prevention of forest invasion, representatives or prevention network are formed in the community to inform and teach the people about mangrove forest management or conservation, called "community council for mangrove forest development". The village chief is the president. The committee consists of chosen village headmen and community leaders." (Namphon Petchkham, 2011)

From the study on other factors and conditions that promote or support the 2 projects or institutes mentioned above in mangrove forest management, there were some similar and different factors and conditions. To find special factors and conditions, which are important and as correct as possible, the researcher studied from 3rd mangrove forest resource development station (Klung, Chanthaburi) by using in-depth interview with institute director. He stated, "About other important conditions or factors that affect to mangrove forest management of the institute in the community, I will firstly mention about community's participation with the institute in managing the existing mangrove forest. The benefits of such management primarily belong to the community. Importantly, the method must be compatible with the community's occupation or previous lifestyle. In addition, municipality contributes some budget but it is quite important. Another important factor is probably closeness with local people. This is also important factor. I have been working in government service for over 15 years. I can say that I have become native person and most officers are local people. So we trust one another. And strictness according to legal regulation is required for the operation. Important problems and obstacles in the operation consist of the lack of manpower. 2nd mangrove forest resource development station solved this by forming community network as institute representative." (Winai Boonlom, 2011)

The last institute or project, of which other special factors and conditions were studied has mangrove forest conservation group to propel the community's mangrove forest management. In-depth interview was conducted with an important leader of Banprednai community mangrove forest conservation group, Huangnamkhao subdistrict, Muang district, Trat. The group leader mentioned about other important factors or conditions beside from environmental education, "Other factors or conditions that contribute to the success of Banprednai mangrove forest management are obvious results they received regarding to increasing sea crabs, which are the

source of food and income for the community. Another factor is about relationship. This is part in the success of mangrove forest management. However, the main point is people's participation in management and the use of the forest as the people, who make a living from the forest and understand the principle of conservation. Previously, many people cut the woods and we always patrolled. However, when the people understand the principle of forest conservation or management that they can utilize the wood appropriately, they turned to maintain the forest and take care of it for the community. Therefore, if there anyone who cut the woods without the committee's permission, the villagers nearby will inform the committee immediately. They work like community's security guards. At the same time, illegal fishing tools used in conserved area are ordered to be taken out of conserved mangrove forest area, such as fish trap or poison. Furthermore, our local administrative organization supports everything fully. About problems and obstacles in mangrove forest management, there are many of them. Conservation group has taken these matters into the meeting to discuss monthly in order to determine measures to solve the problems. The important solution is cooperation of nearby communities in 6 subdistricts to help conserve aquatic animals and mangrove forest together. The problem about maintaining fertile forest at the current point, coastal erosion is the biggest problem, which extremely affects to mangrove forest management. This problem is caused by the nature. We solved this problem by binding 6 tires and pour the cement inside. Then we place it in appropriate point to slow down the tide." (Amporn Patsart, 2011)

From the study on 2 government institutes, 1 project in royal ides, and 1 successful community in mangrove forest management, it can be concluded that other factors and conditions that promote or support successful projects/institutes responsible for mangrove forest management consist of:

1. Participation of the community in every process, every steps of mangrove forest management is the community's own resource. It builds the sense of possession on the forest. And there are activities for the community's mangrove forest.

2. The characteristic or method in mangrove forest management is not complex. It is compatible with community lifestyle. And the results from mangrove forest management cause obvious benefits to the community.

3. Local administrative organizations and local institutes support or participate in mangrove forest management.

4. The institutes or the projects analyze the conditions and factors that cause the problems. They also provide the solutions to reduce difficulty in mangrove forest management.

4.2.3 Appropriate Environmental Education Model for Mangrove Forest Management on The Eastern Part of Thailand

New environmental education model for mangrove forest management appropriate for the eastern coast of Thailand was synthesized by using participatory action research (PAR) from successful or the main environmental education models of the institutes or projects in eastern part.

4.3.2.1 Development process of participatory environmental education for permanent mangrove forest management on the eastern coast of Thailand

The development of environmental education uses participatory action research (PAR) to propel and integrate. It applies successful or the main environmental education models of target institutes or projects to analyze and synthesis from stakeholders comprehensively, including:

1) The director or representative of Khungkraben bay royal development study center project, Chanthaburi

2) The head or representative of 2nd mangrove forest resource development station (Tasorn, Chanthaburi)

3) The head or representative of 3rd mangrove forest resource development station (Klung, Chanthaburi)

4) The chief or representative of department of natural and environmental resources, Chanthaburi

5) The chief or representative of division of natural and environmental resources, Chanthaburi provincial administrative organization

6) The president or representative of Chanthaburi provincial administrative organization

7) The president or representative of Bangsakao subdistrict administrative organization, Chanthaburi

8) Member or representative of provincial council, Lamsing district, Chanthaburi

9) Community leaders of Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons from each area

10) Representatives of heads of the families in Bangsakao subdistrict, Lamsing district, Changhaburi, 1 person from each area

11) Representative of aquatic animal breeders in Bangsakao subdistrict, Lamsing, Chanthaburi, 2 persons from each area

12) The director or representative of Bangsakao school

13) Representatives of environment and mangrove forest conservation group in Bangsakao subdistrict, Lamsing district, Chanthaburi, 2 persons

14) Representatives of Banprednai mangrove forest conservation group in Huangnamkhao subdistrict, Muang district, Trat, 2 persons.

The total number is 38 persons. This is to attain the most appropriate environmental education model in mangrove forest management. The procedures conducted through workshop are as follows.

1) Collectively study on successful environmental education model of each project or institute together with the result obtained from the study on 2 institutes, 1 project, and 1 community chosen for the phase of environmental education model analysis.

2) Collectively analyze the most successful environmental education models of each project or institute and other factors or conditions that affect to mangrove forest management together with the results obtained from the study on 2 institutes, 1 project, and 1 community chosen during the phase of environmental education model analysis and finding other factors or conditions that affect to mangrove forest management.

3) Collectively synthesize environmental education model appropriate for mangrove forest management in eastern coastal provinces.

4) Apply environmental education model appropriate for mangrove forest management on eastern coast with primary result to attain participatory environmental education for permanent mangrove forest management on eastern coast.

The workshop for the development of participated environmental education model for sustainable mangrove forest management

1st November 2011

At Fish House-Crab Bank Learning Center, Bangsakao Subdistrict, Lamsing District, Chanthaburi

8.30 – 9.00 o'clock Report oneself.

9.00 – 9.30 o'clock Make a speech and open the conference by the president of Bangsakao subdistrict administrative organization.

9.30 – 9.45 o'clock Group relations (Mr.Chavalit Kigpiboon)

9.45 – 10.20 o'clock Creation of knowledge and awareness in mangrove forest management by considering on the most successful environmental education models of each project or institute as well as other factors or conditions that affect to mangrove forest management (5 target institutes)

1) Create mutual understanding and agreement (Mr.Chavalit Kigpiboon)

2) Review the actual condition, the participants are divided into 4 groups

2.1 Mangrove forest problem in Chanthaburi

2.2 Previous environmental education model for mangrove forest management

3) Thinking about desirable picture

3.1 Future desirable mangrove forest management

3.2 Environmental education model for desirable mangrove forest management

10.20 – 10.30 o'clock Break

10.30 – 12.00 o'clock The creation of desirable picture for mangrove forest management with community's participation (Mr.Chavalit Kigpiboon)

1) Alternatives for mangrove forest solution or management

2) Determination for the development of environmental education for mangrove forest management

12.00 – 13.00 o'clock Lunch

13.00 – 13.30 o'clock Determination for the development of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand (Mr.Chavalit Kigpiboon)

13.30 – 14.30 o'clock The development of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand (Mr.Chavalit Kigpiboon)

14.30 – 14.40 o'clock Break

14.40 – 15.0 o'clock The development of participatory environmental education for mangrove forest management in Chanthaburi (continue)

15.10 – 15.40 o'clock Conclusion (Mr.Chavalit Kigpiboon)

1) Participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand

15.40 – 16.00 o'clock Make a speech to close the conference by Prof. Asst. Dr. Chaiyon Praditsilp

Facilitate the conference by Mr.Chavalit Kigpiboon

4.2.3.2 Results from the development of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand

From the study on environmental education model for mangrove forest management of the stakeholders, there are **5 important compositions of participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand, including:**

1) Objective of expected environmental education model: The persons, who have completed sustainable mangrove forest management workshop, must have good behavior toward mangrove forest management due to having knowledge about mangrove forest management, awareness of mangrove forest management problem, good attitude toward mangrove forest management, having good skill in solving mangrove forest management problem, being able to evaluate mangrove forest management in different projects, and participation in mangrove forest management, which meets the objective and government policy regarding to mangrove forest.

2) The curriculum contains the content about mangrove forest management, which allows the community to participate

3) Activity process is participatory workshop. It allows everyone to express their opinions freely under the rule and agreement of the group. Any agreement or rule is based on majority.

4) Conduct assessment to examine the achievement of environmental education model

5. The increase or additional of other special factors and conditions that promote or support workshop-approach environmental education model for successful mangrove forest management, including:

5.1 Participation of the community in every process and every activity contained in environmental education model for creating sense of possession.

5.2 Characteristic or method of the activity is not complex. It is compatible with community lifestyle.

5.3 The result of activities contained in environmental education model causes obvious benefits for the community.

5.4 Local administrative organization and local institutes, such as temples, schools, public health centers, police stations, support mangrove forest management.

The concept idea of participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand attained from the phase of environmental education model develop for mangrove forest management was combined with the study of primary information. It was found that **knowledge,**

understanding and experience in mangrove forest management are important factors that affect to people's participation behavior in mangrove forest management in eastern coastal provinces of Thailand. Such 2 important factors mentioned above must be found in target group, which is taken into participatory environmental education model for mangrove forest management, leading to the success of mangrove forest management.

From the result of such study, important target group can be identified. **Community leaders are the majority** among social group members or accounted to 43.68%. At the same time, it was also found that most community leaders had experience in mangrove forest management at medium and high levels (from Table 4.9). Most community leaders had knowledge and understanding in mangrove forest management at medium and high level too (from Table 4.10).

Table 4.9 The number of persons with experience in mangrove forest management of each social group in Chanthaburi

Social group	Level of experience in mangrove forest management		
	Low (0 time)	Medium (1-4 times)	High (5 times and above)
1. Non-members	39	56	19
2. Community leaders	3	55	18
3. Volunteer women and housewives	4	33	6
4. Volunteer youths	0	2	0
5. Conservation group	1	6	2
6. Others	12	26	6

From Table 4.9, most community leaders have experience in mangrove forest management at medium (1-4 times) and high (5 times and above) level respectively.

Table 4.10 The number of persons with knowledge and understanding about mangrove forest management of each social group in Chanthaburi

Social group	Level of understanding in mangrove forest management		
	Low (<6 scores)	Medium (6-9 scores)	High (10 scores)
1. Non-members	9	71	34
2. Community leaders	20	46	10
3. Volunteer women and housewives	1	33	9
4. Volunteer youths	0	2	0
5. Conservation group	0	4	5
6. Others	3	32	9

From Table 4.10, it was found that most community leaders had understanding about mangrove forest management at medium level (6-9 scores)

From the finding during the study of primary information and the development of environmental education model for mangrove forest management, **the attained target group appropriate for participatory environmental education model for sustainable mangrove forest management on eastern coast was community leader group.** Therefore, obtained environmental education model is as follows.

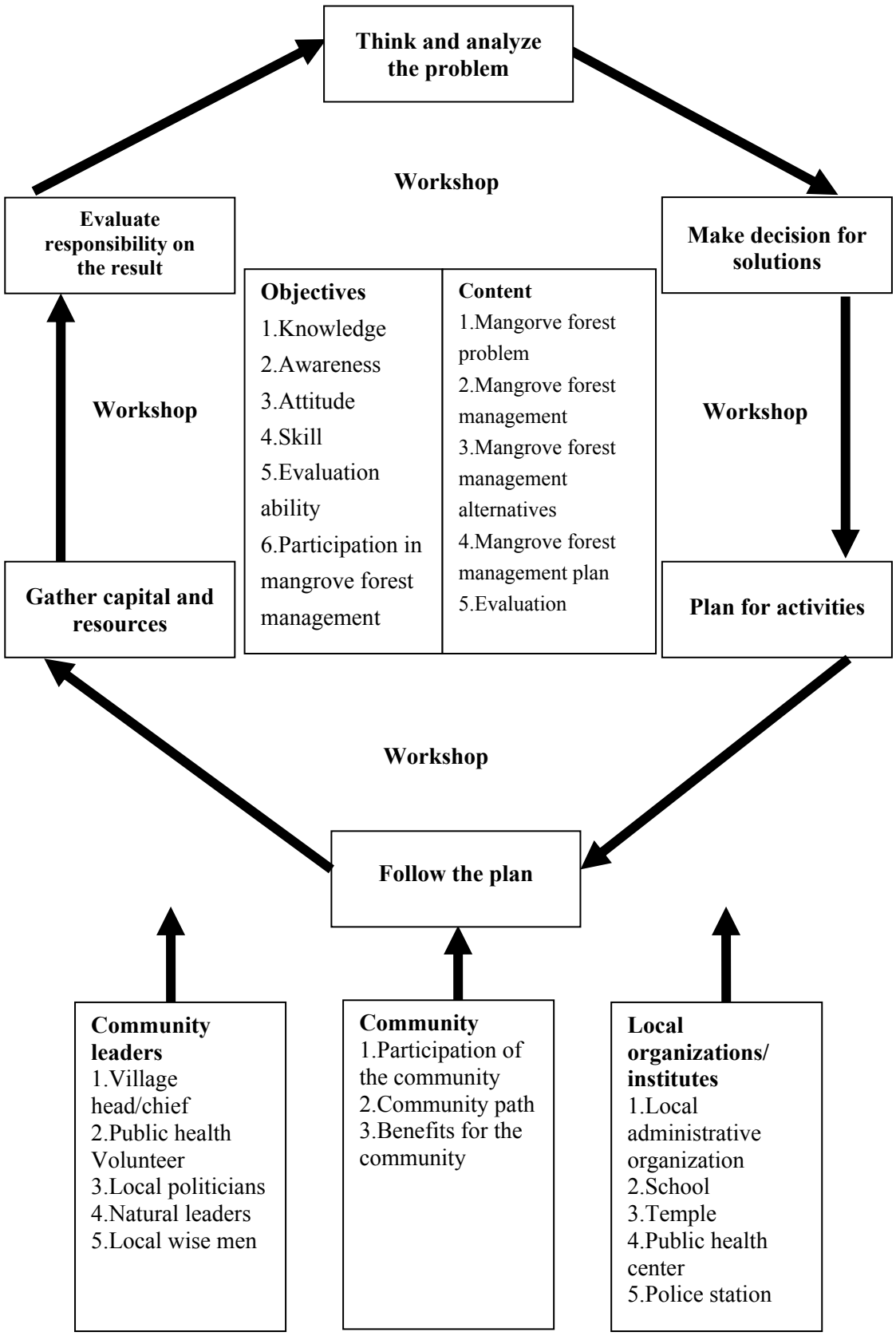

Figure 4.2 Participated Environmental Education Model

4.3 Preparation of Environmental Education Activity and Evaluation of Environmental

Education Model

Step 1: Preparation

1.1 Assign Sanamchai subdistrict, Nayaarm district, Chanthaburi as operating site and target group is 40 community leaders in Sanamchai subdistrict

1.2 Spent budget 24,000 Baht and some parts contributed by the researcher

1.3 Determine environmental education model for the operation as workshop

1.4 Prepare the target group or the community for participation in village meeting and explanation through village heads' meeting at district level.

Step 2: Operation

2.1 Project name: Workshop for sustainable mangrove forest management in Chanthaburi

2.2 Principle and reason:

Mangrove forest area on eastern cost of Thailand cover the area in 5 provinces, including Trat, Chanthaburi, Rayong, Chachoengsao, and Chonburi. From the survey by National Research Institute and Department of Forestry in 1975, Trat occupied mangrove forest area 66,250.00 rai, Chanthaburi occupied mangrove forest area 163,125.00 rai, Royong occupied mangrove forest area 34,375.00 rai, Chonburi occupied mangrove forest area 23,750.00 rai, and Chachoengsao occupied mangrove forest area 18,750.00, totally 306,250.00 rai. Later in 2004, the latest survey was conducted. This is considered the current reference since the cycle period of survey is about 3-5 years. It was found that Trat occupied mangrove forest area 64,812.50 rai, Chanthaburi occupied mangrove forest area 56,106.25 rai, Rayong occupied mangrove forest area 10,450.00 rai, Chonburi occupied mangrove forest area 2,781.25 rai, and Chachoengsao occupied mangrove forest area 8,031.25 rai, totally 142,181.25 rai in 2004. The amount of lost mangrove forest area since 1975 is 164,068.75 rai or accounted to 53.57% of mangrove forest area in 1975.

The loss of mangrove forest area on eastern coast can be compared by year.

Table 4.11 Mangrove forest area in eastern part of Thailand

Province	Mangrove forest area (rai)				
	Year 1975	Year 1996	Year 2000	Year 2002	Year 2004*
Trat	66,250.00	47,086.50	59,482.00	49,533.00	64,812.50
Chanthaburi	163,125.00	24,332.25	75,580.00	46,885.25	56,106.25
Rayong	34,375.00	4,103.00	11,764.00	5,946.00	10,450.00
Chonburi	23,750.00	575.00	4,461.00	1,900.00	2,781.25
Chachoengsao	18,750.00	3,015.75	10,917.00	3,015.75	8,031.25
Total	306,250.00	79,112.50	162,204.00	104,264.00	142,181.25

Source: Eastern Marine and Coastal Resources Research Center, 2006

Note *: The latest survey on mangrove forest area was conducted in 2004. The cycle of survey is about 3-5 years. Therefore, the current reference relies on the survey conducted in 2004.

From Table 4.12, it can be seen that in 2004, which is the current reference, the province with the most mangrove forest area of eastern part of Thailand is Trat. It has remaining mangrove forest area 64,812.50 rai. The province with the least mangrove forest area is Chonburi. It has remaining mangrove forest area 2,781.25 rai. At the same time, **the province that has lost the most mangrove forest area is Chanthaburi at the amount of 107,018.75 rai or 65.61% of previous amount of the area in 1975.**

Important cause of the loss of mangrove forest area on eastern coast of Chanthaburi from 1991 is the change of mangrove forest area for aquatic animal breeding, mostly prawn farms. This is because the eastern coast of Chanthaburi is appropriate for sea prawn breeding, which is economic animal profitable for investment. Thus, sea prawn breeding expands rapidly. Moreover, government support on prawn breeding for national income causes Chanthaburi to have the most prawn farm area of the country without considering on the loss of mangrove forest area.

When prawn breeding has continued for certain period, the environment of the current farm will no longer appropriate for prawn breeding due to accumulation of toxins used in prawn breeding activity. The search for new location for breeding is necessary in order to maintain production that supplies the market. Therefore, mangrove forests are being invaded increasingly. The expansion of industry and community has decreased mangrove forest area up to 69.38%. In the survey on mangrove forest area in 1996, mangrove forest area remained only 24,332.25 rai (Department or Marine and Coastal Resources, 2008).

Considerable loss of mangrove forest area in Chanthaburi, including former abandoned mangrove forest, is due to deterioration of sea prawn breeding and accumulated toxin from prawn breeding. This affects to traditional lifestyle of local people living nearby mangrove forest or the coast. Marine resources used for living, such as fishes, crabs, prawns, clams, etc. have extremely decreased. Coastal erosion due to the tide is more severe. Wind and tide blowing against the coast are strong enough to damage coastal communities. Institutes related to mangrove forest turned to look at Chanthaburi, which was in crisis due to unbalanced coastal environment. Therefore, since 1994, Chanthaburi ran a campaign for forestation and restoration of mangrove forest by government and private organizations continuously and seriously. Furthermore, the government and Department of Forestry issued measures to maintain and protect mangrove forest area, such as mangrove forestation by using government budget. This increased the amount of mangrove forest area to 75,580 rai from the survey in 2000.

At the same time, more fertile mangrove forest in 2000 retrieved good mangrove forest ecology. The condition appropriate for sea prawn breeding returned. Furthermore, prawn breeding technologies, which had been being developed continuously, decrease the risk of loss or death in sea prawn breeding. American and Asian markets highly demand for sea foods. Therefore, sea prawn breeding boomed again. Moreover, many large companies invested in sea prawn breeding. Private's former mangrove forestation areas were used as sea prawn farms again. Measures and regulations were violated and ignored by many sides and mangrove forest areas were widely invaded. Thus, mangrove forest area surveyed in 2002 remains only 46,885 rai.

The impact from the decrease of mangrove forest causes human to lose the resource, the large fortress that prevent wind and tide. Mangrove rooting system helps precipitate the sediments and clump the clay, resisting against erosion. When mangrove forest is destroyed, wind and tide will crash and erode the coast severely. And precipitation of clay around the coast does not occur. This reduces coastal area gradually. Coastal erosion also destroys coastal ecology and lives, such as sea weed and coral reef. This deteriorates natural fertility of coastal ecology. From such situation, property or function of carbon dioxide reduction, waste absorption, and important food source has also disappeared.

From the problem of coastal erosion, the seashore has lost its fertility of being breeding and nurturing source of aquatic animals, including crabs, fishes, prawns, clams, and other aquatic animals. These aquatic animals are considered economic animals because the annual value of Thailand's aquatic animals trading is tremendous. Therefore, these aquatic animals decrease gradually until fishermen or fishery businesses are not able to run their activities anymore. Thus, the people lose their income as well as national revenue. In addition, depletion of natural fertility and beautiful scenery reduces the number of tourists. This affects to tourism industry, which is currently considered as the source of major income of the country. Thus, the income of the communities, businesspersons, and national revenue has decreased.

Since most communities located on the coast have their daily life related to mangrove forest and the sea, when they have lost coastal area, they also lost their residence and workplace. So, they cannot live in their land anymore. They have to migrate to other areas. This changes the community's traditional culture since they have to adapt themselves to the new environment (Natural Resources and Environmental Policy and Planning Office, 2007).

The impact mentioned above happened to the people living in mangrove forest area in Chanthaburi. The level of severity depends on the condition and amount of mangrove forest area lost.

From such reason, it is necessary to manage mangrove forest in Chanthaburi appropriately by determining policies and measures to manage mangrove forest resources. The policies and measures aim to increase the area and restore mangrove forest ecology by dividing mangrove forest area into conserved zone and

economic zone, prohibit the use of mangrove forest area strictly, and revoke mangrove forest concession. Sub-institutes are organized to manage mangrove forest in local areas, including 2nd mangrove forest resource development station (Tasorn, Chanthaburi), 3rd mangrove forest resource development station (Klung, Chanthaburi), and special project, such as Kungkraben bay research and development center in royal idea. They collectively carry on activities about mangrove forest conservation and restoration, namely determining conservation measure and planning for mangrove forest resources management, study, analyze, research, and plan for land use for conservation and restoration of mangrove forest resource, which affect to the environment and ecology, give advice, recommend and disseminate knowledge and technologies about mangrove forest, management for conservation, restoration, protection and suppression of culprits, coordination with other relevant institutes, collaborate, support the operation of other relevant or assigned institutes (Department of Marine and Coastal Resources, 2008).

Later, the government determined the policy regarding to holistic mangrove forest management relying on community's participation together with good management of government sector and expanded role of local administrative organization. Consequently, Chanthaburi has many institutes and organizations as well as groups of people or community that participate in mangrove forest management, including Provincial Office of Natural and Environmental Resources, Division of Natural and Environmental Resources or Environmental Faction in Provincial Administrative Office, and special administrative institutes, such as municipality, subdistrict administrative organization in Chanthaburi. These organizations have function and role in mangrove forest management according to legal scope. They have different methods in mangrove forest management corresponding to regional condition. Most appears in different forms, such as creating community's conscious to highly value the resource, planning and setting sustainable utilization regulation, protection and surveillance of mangrove forest and coastal resource, reforesting and restoring deteriorated forest, increasing biodiversity in mangrove forest ecology, developing learning center by using natural media, and being ecological traveling place. Mangrove forest management in Chanthaburi directs toward participation of local community increasingly. This is because the community is directly affected.

They are close and understand about their own local natural resources. They are having more roles and potential. In addition, mangrove forest conservation activity also extends the result to diverse activities with intensive community's participation in propulsion. Serious operation resulted in the increase of mangrove forest area in 2004 at 56,106.25 rai.

However, the tendency of the loss of remaining mangrove forest area of Chanthaburi still exists. From the statement of Mr.Samran Rakchart, director of Department of Marine and Coastal Resources, he stated that Chanthaburi and Trat had so many prawn farms. For example, Chanthaburi previously had more than 2 hundred thousand rai of mangrove forest. But it remains only 60 thousands rai now. The rest or areas are prawn farms (Matichon, 20th December 2008).

Various information suggests that mangrove forest area on the eastern coast of Thailand, **especially in Chanthaburi, is confronting invasion and destruction. It tends to lose more mangrove forest area increasingly** mainly due to human action. This problem must be solved urgently.

The loss of mangrove forest area on eastern coast of Sanamchai subdistrict, Nayaarm district, Chanthaburi, is mainly due to human action. This implies the lack of knowledge and understating about mangrove forest behind their action. Therefore, to solve mangrove forest problem, it is necessary to create knowledge and understanding about mangrove forest to the people, which leads to behavioral change, the action that does not cause adverse impact to mangrove forest. This covers collective think, act, and determination of strategy or community's operation in order to develop and maintain the community's mangrove forest. The process to teach about mangrove forest is workshop for sustainable mangrove forest management. This is the origin of this project.

2.3 Objectives

2.3.1 Increase understanding, attitude, awareness, and cooperation of participants in the meeting of sustainable mangrove forest management.

2.3.2 Establish mutual agreement or regulation and plan for mangrove forest management for the community.

2.3.3 Find the method to cooperate between government institutes, private sector, and the community in following community's plan in mangrove forest management.

2.4 Meeting holder: Sanamchai subdistrict administrative organization, Nayaarm district, Chanthaburi

2.5 Participants or target group: 40 community leaders

2.6 Location and date: Conference room of Sanamchai subdistrict healthcare hospital, Nayaarm district, Chanthaburi, on 7th December 2011, at 8.00 – 16.30 o'clock

2.7 Meeting plan:

Date/month/year

08.00 – 08.30 o'clock Registration

08.30 – 09.00 o'clock Meeting open ceremony

09.00 – 09.15 o'clock Ice breaking (lead to workshop content)

09.15 – 10.15 o'clock Create knowledge and conscious in mangrove forest management

1) Create understanding and mutual agreement about the activity that participants must operate in mangrove forest management

2) Review the actual condition

2.1) Mangrove forest problem of target area

2.2) Previous and current mangrove forest management

3) Desirable and expected picture

3.1) The most appropriate mangrove forest management for target area

3.2) Mutual agreement or community's regulation and community's plan for mangrove forest management

10.15 – 10.30 o'clock Break

10.30 – 12.00 o'clock Study mangrove forest management alternatives participated by the community

12.00 – 13.00 o'clock Lunch

13.00 – 14.00 o'clock Group activity (10 persons for each group)

Determine mutual agreement or community's regulation for mangrove forest management

14.00 – 15.00 o'clock Create community plan for mangrove forest management in addition to old community's plan

15.00 – 15.15 o'clock Break

15.15 – 16.00 o'clock Conclude workshop

1) Mutual agreement or community's regulation

2) Community's plan for mangrove forest management in addition to old community's plan

3) The method to bring community's regulation and plan for mangrove forest management into practice

16.00 – 16.30 o'clock Close the meeting.

2.8 Budget: Researcher 24,000 Baht

2.8.1	Lunch, 1 meal 40*80	equal to	3,200 Baht
2.8.2	Snack, 2 meals 40*20*2	equal to	1,600 Baht
2.8.3	Trainer, 5 persons 4*2,000	equal to	8,000 Baht
2.8.4	Place	equal to	2,000 Baht
2.8.5	Sound system	equal to	2,000 Baht
2.8.6	Vehicle for 50 persons 40*100	equal to	4,000 Baht
2.8.7	Material for the meeting	equal to	2,000 Baht
2.8.8	Meeting document	equal to	1,200 Baht

2.9 Expected results:

2.9.1 Workshop participants know about mangrove forest management. They realize about mangrove forest problem. They have good attitude on mangrove forest management. They have good skill in solving mangrove forest management issue and able to evaluate mangrove forest management in projects. They participate in mangrove forest management.

2.9.2 Workshop participants are able to apply the conclusion for community's mangrove forest management effectively.

2.9.3 Community's mangrove forest is maintained. It offers benefits to the community and remains with the community permanently.

2.10 Evaluation:

2.10.1 Evaluation before and after workshop (Pre – Test and Post – Test)

4.3.1 General Information of The Samples

Sanamchai subdistrict, Nayaarm district, Chanthaburi consists of 8 villages. However, there are 2 villages with mangrove forest area, namely mu.4 Paktapone village, population 322 persons, 102 households, and mu.7 Taklang village, population 898 persons, 300 households. The total numbers are 402 households and 1,220 persons in 2 villages.

About general information of the samples, who are community leaders and family heads or representatives of households, collected by using 40 questionnaires from the randomly selected samples, there are 10 samples are from mu.4 Paktapone village and 30 samples from mu.7 Taklang village, totally 40 persons. The questionnaire includes gender, age, occupation, education, income, number of household member, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation.

Table 4.12 Number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation)

Sample characteristics	Number	Percent	Note
1.Gender			
Male	10	25.00	
Female	30	75.00	
Total	40	100.00	
2.Age			Mean = 39.32
21 – 30 Years	2	5.00	Maximum = 55
31 – 40 Years	23	57.50	Minimum = 28
41 – 50 Years	12	30.00	S.D. = 6.65
51 – 60 Years	3	7.50	
Total	40	100.00	
3.Education			
Lower primary education	0	0.00	
Upper primary education	13	32.50	
Lower secondary education	15	37.50	
Upper secondary education	10	25.00	
Diploma or equivalent	1	2.50	
Bachelor’s degree	1	2.50	
Total	40	100.00	

Table 4.12 Number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation) (cont.)

Sample characteristics	Number	Percent	Note
4.Major occupations			
Prawn farm	14	35.00	
Fish farm	1	2.50	
Clam farm	0	0.00	
Crab farm	1	2.50	
Fishery	6	15.00	
Gardening	6	15.00	
Paddy farm	1	2.50	
Growing vegetables	0	0.00	
Integrated agriculture	1	2.50	
Poultry farm	0	0.00	
General employment	3	7.50	
Trading	6	15.00	
Government service	0	0.00	
Others	1	2.50	
Total	40	100.00	
5.Income			Mean = 260,425.00
Less than 50,001 Baht	1	2.50	Maximum = 550,000
50,001 – 250,000 Baht	21	52.50	Minimum = 50,000
250,001 – 450,000 Baht	15	37.50	S.D. = 138,918.30
450,001 – 650,000 Baht	3	7.50	
Total	40	100.00	

Table 4.12 Number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation) (cont.)

Sample characteristics	Number	Percent	Note
6.Number of family members			Mean = 4.15
Less than 3 persons	2	5.00	Maximum = 6
3 persons	9	22.50	Minimum = 2
4 persons	15	37.50	S.D. = 1.08
5 persons	9	22.50	
More than 5 persons	5	12.50	
Total	40	100.00	
7.Period of settlement			Mean = 16.90
Less than 11 years	3	7.50	Maximum = 45
11 – 20 years	27	67.50	Minimum = 6
21 – 30 years	9	22.50	S.D. = 6.72
31 – 40 years	0	0.00	
More than 40 years	1	2.50	
Total	40	100.00	
8.Size of possessed land			Mean = 10.86
Less than 11 rai	23	57.50	Maximum = 32
11 – 20 rai	11	27.50	Minimum = 1
21 – 30 rai	5	12.50	S.D. = 8.12
More than 30 rai	1	2.50	
Total	40	100.00	

Table 4.12 Number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation) (cont.)

Sample characteristics	Number	Percent	Note
9.Receiving information about mangrove forest management			
Yes	40	100.00	
No	0	0.00	
Total	40	100.00	
10.Source of information			N = 40
Television	35	87.50	
Newspaper/journal/magazine	27	67.50	
Radio	15	37.50	
Internet	18	45.00	
Brochure/flyer/poster	25	62.50	
Government officer or volunteer	10	25.00	
Family members	14	35.00	
Neighbors	10	25.00	
Colleagues	4	10.00	
Attending the meeting / training / seminar	16	40.00	
Academic institutes	32	80.00	
Others	0	0.00	

Table 4.12 Number and percentage of general information of the samples (by gender, age, occupation, education, income, number of family members, period of settlement, size of possessed land, receiving information and information source of the population, and experience in mangrove forest management or conservation) (cont.)

Sample characteristics	Number	Percent	Note
11.Experience in mangrove forest management			N = 40
Yes	40	100.00	
No	0	0.00	
Total	40	100.00	
12.Experience in mangrove forest management			Criterion of grouping:
Low experience	6	15.00	$\overline{X}$ + S.D.
Medium experience	30	75.00	$\overline{X}$= 5.15 , S.D. = 2.25
High experience	4	10.00	

From Table 4.12, responding samples, who live in mangrove forest area in Chanthaburi, are mostly female 75.00%, and male 25.00%. Their average ages is 39 years (mean = 39.32). About education level, most of them graduated lower secondary education (grade 1-3) or 32.50%. Those who do prawn farm are 35.00%. Average household income is 260,000 Baht per year (mean = 260,425). The average number of family members is 4 persons (mean = 4.15 persons). In addition, it was found that most samples have settled in the current area for 17 years averagely (mean = 16.90). The average size of possessed land is about 11 rai (mean = 10.86).

About receiving the information of mangrove forest management, it was found that 100.00% of the samples received mangrove forest management information. Television is the main source, 87.50%.

About experience in mangrove forest management of the samples, 100.00% of them had experience. The average experience in mangrove forest management is 5 times in the latest year (mean = 5.15). When arranged experience level in mangrove forest management, it was found that most samples had medium level of experience or 75.00%.

4.3.2 Knowledge and Understanding about Mangrove Forest Management Before and After Workshop

When measure knowledge about mangrove forest management of all samples before and after the workshop by using the test, consisting of 10 questions, 1 score of each item, totally 10 scores, it was found that before the workshop the samples had knowledge at the lowest level 3 scores, highest level 10 scores and average level 7.98 scores (S.D. = 1.59). After workshop, it was found that they had knowledge at the lowest level 6 scores, highest level 10 scores, and average level 8.45 scores (S.D. = 1.01).

When compared the difference of knowledge before and after workshop by using Paired t – test statistic, it was found that the samples had more knowledge after the workshop at 0.48 score averagely, which is significant at the level of 0.05.

Table 4.13 Comparison of knowledge of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	7.98	1.59			
After	40	8.45	1.01	0.48	3.83	<.001

4.3.3 Attitude on Mangrove Forest Management Before and After Workshop

When measured the attitude in mangrove forest management of all samples before and after workshop by using 10-items attitude test, it was found that before the workshop the samples had attitude at the lowest level 29 scores, highest level 43 scores, and average level 37.12 scores (S.D. = 3.98). After workshop, they

had attitude at the lowest level 34 scores, highest level 46 scores, and average level 41.10 scores (S.D. = 3.10).

When compared the difference between attitude before and after workshop by using Paired t – test statistic, it was found that after workshop the samples had better attitude at 3.98 scores averagely, which is significant at the level of 0.05.

Table 4.14 Comparison of attitude of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	37.12	3.98			
After	40	41.10	3.10	3.98	17.90	<.001

4.3.4 Awareness in mangrove forest management before and after workshop

When measured awareness in mangrove forest management of all samples before and after workshop by using 10-items awareness test, it was found that before the meeting the samples had awareness at the lowest level 24 scores, highest level 43 scores, and average level 36.30 scores (S.D. = 4.91). After workshop, they had awareness at the lowest level 32 scores, highest level 46 scores, and average level 40.93 scores (S.D. = 3.11).

When compared the difference of awareness before and after workshop by using Paired t – test statistic, it was found that after workshop, the samples had better awareness at 4.63 scores averagely, which is significant at the level of 0.05.

Table 4.15 Comparison of awareness of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	36.30	4.91			
After	40	40.92	3.10	4.63	14.04	<.001

4.3.5 Problem-Solving Skill for Mangrove Forest Before and After Workshop

When measured the problem-solving skill for mangrove forest of all samples before and after workshop by using 10-items skill test, it was found that before the meeting the samples had problem-solving skill at the lowest level 24 scores, highest level 44 scores, and average level 35.58 scores (S.D. = 4.45). After workshop, they had problem-solving skill at the lowest level 33 scores, highest level 46 scores, and average level 39.80 scores (S.D. = 3.15).

When compared the difference of problem-solving skill before and after the workshop by using Paired t – test statistic, it was found that after workshop the samples had better problem-solving skill at 4.23 scores averagely, which is significant at the level of 0.05.

Table 4.16 Comparison of problem-solving skill of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	35.58	4.45			
After	40	39.80	3.15	4.23	16.13	<.001

4.3.6 Participation in Mangrove Forest Management Before and After Workshop

When measured participation level in mangrove forest management of all samples before and after workshop by using 10-items participation test, it was found that before the meeting the samples had participation at the lowest level 2 scores, highest level 8 scores, and average level 4.13 scores (S.D. = 1.42). After workshop, they had participation at the lowest level 4 scores, highest level 10 scores, and average level 5.65 scores (S.D. = 1.42).

When compared participation before and after workshop by using Paired t – test statistic, it was found that after workshop the samples had better participation at 1.53 scores averagely, which is significant at the level of 0.05.

Table 4.17 Comparison of participation of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	4.12	1.42			
After	40	5.65	1.42	1.53	16.11	<.001

4.3.7 Ability to Evaluate Mangrove Forest Management Before and After Workshop

When measure the ability to evaluate mangrove forest management before and after workshop of all samples before and after workshop by using 10-items evaluation ability test, it was found that before the meeting the samples had evaluation ability at the lowest level 28 scores, highest level 43 scores, and average level 37.10 scores (S.D. = 3.64). After workshop, they had evaluation ability at the lowest level 35 scores, highest level 45 scores, and average level 41.00 scores (S.D. = 2.47).

When compared evaluation ability before and after workshop by using Paired t – test statistic, it was found that the samples had better evaluation ability at 3.90 scores averagely, which is significant at the level of 0.05.

Table 4.18 Comparison of evaluation ability of the samples before and after workshop

	Number	Mean	S.D.	D	T	P
Before	40	37.10	3.64			
After	40	41.00	2.47	3.90	15.13	<.001

From the test in all 6 aspects, it can be concluded that differences between knowledge, attitude, awareness, problem-solving skill, participation and evaluation skill for garbage management before and after workshop, the average score increased, which is significant at the level of 0.05.

4.4 Procedure for Determination of Community's Regulation and Local Plan Derived from

Participated Environmental Education Model for Sustainable Mangrove Forest Management on Eastern Part of Thailand

After arranging participatory environmental education activity for sustainable mangrove forest management in Sanamchai subdistrict, Nayaarm district, Chanthaburi on the target group, which were 40 community leaders, mostly were public health volunteers and members of Sanamchai subdistrict administrative organization, the workshop concluded 2 following methods in managing mangrove forest in Sanamchai subdistrict, Nayaarm district, Chanthaburi.

4.4.1 Community's Mutual Agreements or Regulations for Mangrove Forest Management in Sanamchai subdistrict, Nayaarm district, Chanthaburi Province, are as follows

1) Do not cut the wood in conserved zone and project in royal idea zone. Whoever violates or trespasses mangrove forest area, the village head or president of subdistrict administrative organization will prosecute against the culprit.

2) Do not add or build construction inside conserved mangrove forest area.

3) Do not release waste water or garbage in mangrove forest area. Whoever violates, the village meeting can blame him.

4) The community reforest and release aquatic animals into the sea at least once a year.

5) In the case that requires to cut the wood in forbidden area, bring the issue to village meeting for resolution.

4.4.2 Plan of The Community or Project Contained in The Plan of Subdistrict Administrative Organization is as follows.

1) Reforestation project in deteriorated or abandoned area after tiger prawn farming in fiscal year 2013

2) Community potential development for sustainable mangrove forest management by teaching about mangrove forest management for the community in fiscal year 2013

3) Aquatic animal species conservation project in mangrove forest area of Sanamchai subdistrict, Nayaarm district, Chanthaburi in fiscal year 2013

4) Develop Sanamchai subdistrict to become ecological tourism place managed by the community.

CHAPTER V
DISCUSSION

This research examines environmental education model for mangrove forest management appropriate for managing mangrove forest on eastern coast of Thailand. The result can be discussed as follows.

5.1 Important Factors Affecting to People's Participation in Sustainable Mangrove Forest Management on Eastern Part of Thailand

It is the study on basic information about mangrove forest issue of the community in Chanthaburi and awareness and understanding of such problem of the people. This leads to knowledge and understanding in the cause of problem, severity level of the problem, result of the problem that affect to the environment and the people, solution, participatory level of people in solving the problem, and important factors that affect to people's participation. The researcher applied the questionnaire to collect the information from 288 samples in villages with mangrove forest area in Chanthaburi. The result of the study is as follows.

Most people, who live in mangrove forest areas in Chanthaburi, have average age 43 years (mean = 42.78). About education of the samples, most of them graduated upper primary education (grade 4-6), accounted to 24.65%. They do prawn farms 22.2%. The average household income is 250,000 Baht per year (mean = 251,848.13). The average number of family members is 5 persons (mean = 4.52 persons). In addition, it was found that most samples settled on the current location for 27 years averagely (mean = 27.02). The size of possessed land is approximately 10 rai (mean = 10.00).

About receiving the information about mangrove forest management, it was found that most samples, 95.80%, received the information about mangrove forest management from television, 83.70%. It was also found that most samples were

members of social groups, 60.40%. Most of them were members of community leader group, accounted to 43.68% from the samples, who were members of all social groups.

About experience in mangrove forest management among the samples, 79.50% of them had experience in mangrove forest management averagely 2 times (mean = 2.35). When ranked the level of experience in mangrove forest management, it was found that most samples had experience at low level or 42.00%.

About measuring knowledge and understanding in mangrove forest management, it was found that most samples had knowledge at medium level 188 persons (65.28%). The next group of samples had high level of knowledge, 67 persons (23.26%). The number of samples group at low level of knowledge is 33 persons (11.46%).

Important factors that affect to people's participation in mangrove forest management in Chanthaburi consist of knowledge and understanding in mangrove forest management and experience in mangrove forest management.

The result of primary information study corresponds to the research of Sombat Thammachote (2548: 119-121) and the research of Samran Rakchart (2548: 101-102). They stated that the people in Sanamchai subdistrict, Krajae district, Nayaarm district, Klongkud subdistrict, Tamai district, and Waeru estuary area, Chanthaburi, where mangrove forests exist, had average age 40 – 50 years. They graduated primary education. The number of family members is about 4-5 persons. Their main occupation is fishery. Their minor occupation is farming. The period of settlement is over 20 years. Most of them possess the land 10 – 20 rai on the average.

About receiving the information about mangrove forest management, it was found that most samples, 95.80%, received the information about mangrove forest management mostly from television, accounted to 83.70%. Corresponding to the research of Amaraporn Sripuajarean (2007), she found that most people were informed about mangrove forest management from television. In contrast with the research of Somsak Piriyayota (1999: 65), he found that most people were informed about mangrove forest management from government institutes and officials.

About experience in mangrove forest management among the samples, it was found that 79.50% of them had experience 2 times averagely (mean = 2.35). Corresponding to the research of Samran Rakchart (2005: 73), he stated that 73.61% of the people living at Waeru estuary, Chanthaburi had experience in mangrove forest management. When ranked the level of mangrove forest management experience, it was found that most samples had experience at low level, 42.00%.

About measuring knowledge and understanding in mangrove forest management, it was found that most samples, 188 persons (65.28%) had knowledge at medium level. The next sample group, 67 persons (23.26%), had high level of knowledge. The number of samples with low knowledge level is 33 persons (11.46%). Corresponding to the research of Surasak Woraphakabunya (2004), he stated that most people had knowledge and understanding in mangrove forest conservation or management at medium level. However, in the research of Samran Rakchart (2005: 74), he found that the people in mangrove forest area of Waeru basin, Chanthaburi had high level of knowledge and understanding in mangrove forest management.

About the study on important factors that affect to people's participation in mangrove forest management in Chanthaburi, it was found that knowledge and understanding of mangrove forest management and experience in mangrove forest management are important factors that affect to people's participation in mangrove forest management. However, in the research of Samran Rakchart (2005), he found that factors that relate to people's participation in mangrove forest management include education level, period of settlement, major occupation, household income, size of possessed land, training, experience in mangrove forest management and experience in working with the officers. The research of Surasak Woraphakabunya (2004) also stated that social and economic factors related to people's participation in mangrove forest conservation or management, including age, education, minor occupation, and being member of social group.

5.2 The Development of Participated Environmental Education for Sustainable Mangrove Forest Management on Eastern Part of Thailand

This is the development of environmental education model from academic works, documents, or primary or secondary procedure of 3 successful institutes and 1 community in mangrove forest management as appropriate for managing mangrove forest on eastern coast. The newly obtained knowledge, procedure, or process as well and implementation of environmental education model from 3 institutes and 1 community were improved as the most appropriate environmental education model for mangrove forest management. From the result, it was found that the best environmental education model is non-formal environmental education in workshop form. The important compositions include content, objective, and government policy regarding to mangrove forest, purpose of environmental education, objective of environmental education model, activity strategy, and evaluation. The result corresponds to academic document of Kasem Chunkao (1993). He stated that workshop is a form of non-formal environmental education. The workshop is arranged to find the practice to solve certain problem comprehensively. This proceeding attains mutual resolution, causing the solution to be accepted by every side. This is appropriate for solving the community's mangrove forest issue in eastern coastal provinces.

Other important factors and conditions that support successful mangrove forest management include community's participation in every step of mangrove forest management and proceeding characteristic or practice in mangrove forest management is simple and compatible with community's lifestyle. The executives of the institute or project related to mangrove forest management need smart administration. They must know how to integrate academic principle with local operation. Finally, the institute or project needs the practice to decrease conflict or obstacle in work. Such finding corresponds to the research of Col.Prachoom Maturamon (2002). He stated that in participation or support of the people or target group in successful activities, the target group will learn and understand the objective and strategy of the operation. In addition, it corresponds to the research of Marion

Glaser , Uta Berger and Rosangela Macedo (2003). They proposed the result that Para State's community connectively determined social measure and the method for utilizing their own mangrove forest. Consequently, mangrove forest, which was at risk of invasion and deforestation, had less risk.

After that, primary result was taken into the development by the experts in the area of environmental education and mangrove forest management as well as stakeholders of every sector to participate in the development of environmental education. Environmental education model caused by participation of every side consists of 5 major compositions, including 1.Objective of environmental education model required to happen to the target group. 2.The curriculum contains the content about mangrove forest management that opens an opportunity for the community to participate in the operation. 3.Procedure of environmental education model applies workshop that can achieve the result on positive behavior toward mangrove forest management by focusing on participation of the participants. 4.Conduct evaluation after the meeting to examine efficiency and effectiveness of workshop 5.Other special factors and conditions that support the workshop for more successful mangrove forest management are, for example, simple activity, which is compatible with lifestyle of target group, the community, and community leaders as well as local organizations.

To increase efficiency and effectiveness of participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand, the researcher applied important factors that affect to people's participation in mangrove forest management or the result from the first step in environmental study until the perfect model is attained. This model can adjust people's behavior from having knowledge, understanding, good attitude, awareness, problem-solving skill, evaluation ability, and more participation in mangrove forest management. Corresponding to academic document of Sonjai Hawanon (2000), she stated that mangrove forest management or conservation essentially requires the measure to teach the people related to mangrove forest to realize the importance of permanent mangrove forest management.

Table 5.1 Successful environmental education models in the study

Type	Procedure	Activity
1.Formal environmental education	Systematic education focusing on lecturing in the class	Lecture, demonstration, training, discussion, project
2.Non-formal environmental education without target group's participation	Communication through mass media	Television, radio, newspaper, document, and journal
3.Non-formal environmental education with target group's participation	Disseminate knowledge from a person to another person through discussion or lecture	Training, seminar, workshop, demonstration

Advantages of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand comparing to previous environmental education model

1. The achievement of the persons, who have been through environmental education process, especially in knowledge and understanding about mangrove forest management, is better than other environmental education models. This is because the target group, which is community leaders, has their background experience. Additional part makes them understand better.

2. The content of environmental education covers community's issue. Thus, the community needs to know to solution for threatening problem.

3. Workshop is very good method to find solution for certain problem. This provides mutual resolution. Thus, the solution is accepted by every level in the community.

4. It takes short time. The participants are not bored. Various places can be used. It is cost-saving.

5. Evaluation can be conducted systematically, for example, evaluation after workshop, evaluation after the operation. Moreover, it is substantial.

6. Important thing from participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand is local researcher team.

5.3 Arrangement of Environmental Education Activity and Evaluation of Environmental Education Activity

This is the test of participatory environmental education for sustainable mangrove forest management in Chanthaburi. It began with random sampling for target site at district level. Nayaarm district was chosen. Then randomly sample for subdistrict level. Sanamchai subdistrict was chosen. The chosen villages with mangrove forest area were mu.4 Paktapone village and mu.7 Taklang village. After that, bring environmental education for mangrove forest management into environmental education process. Input factors of environmental education include target population, which are the heads or representatives of households, environmental education project, which applies curriculum or workshop, activities related to environmental education model, which are learning activities with the application of media and technologies for teaching, and the environmentalist, the researcher who arranged environmental education activity. Evaluation of knowledge and understanding about mangrove forest management, awareness and sensitivity on mangrove forest issue, attitude and supportive feeling on mangrove forest management, skill in solving mangrove forest issue, evaluation ability in mangrove forest issue, and participation level in mangrove forest issue, was conducted before and after environmental education activity. They target population, which were heads or representatives of households, were inquire to fill the questionnaire. From the evaluation before and after environmental education, it was found that:

About the difference between knowledge about mangrove forest management before and after the workshop among 40 samples, it was found that before the workshop the samples had knowledge at average score of 7.98. After the workshop, the average score was 8.45. The samples had increased knowledge at 0.48 score averagely, which is significant at the level of 0.05.

About the difference between attitude before and after workshop of 40 samples, it was found the before the workshop the samples had average attitude score 37.12. After the workshop the average attitude score was 41.10. The samples had increased attitude at 3.98 averagely, which is significant at the level of 0.05.

About the difference between awareness before and after the workshop of 40 samples, it was found that before the workshop the samples had average awareness score 36.30. After the workshop the average awareness score was 40.93. The samples had increased awareness at 4.63 averagely, which is significant at the level of 0.05.

About the difference between problem-solving skill before and after the workshop of 40 samples, it was found that before the workshop the samples had average problem-solving skill score 35.58. After the workshop the average problem-solving skill score was 39.80. The samples had increased problem-solving skill at 4.23 averagely, which is significant at the level of 0.05.

About the difference between evaluation ability before and after the workshop of 40 samples, it was found that before the workshop the samples had average evaluation ability score 37.10. After the workshop the average evaluation ability score was 41.00. The samples had increased evaluation ability at 3.90 averagely, which is significant at the level of 0.05.

About the difference between participation before and after the workshop of 40 samples, it was found that before the workshop the samples had average participation score 4.13. After the workshop the average participation score was 39.80. The increase is significant at the level of 0.05.

The result shows that participatory environmental education model for sustainable mangrove forest management in Chanthaburi or workshop for sustainable mangrove forest management in Chanthaburi is able to improve knowledge, attitude, awareness, problem-solving skill, evaluation ability, and participation in mangrove forest management. Corresponding to the research of Waraporn Srisuphan et al. (2008), she found that after collective activity of professional practitioners specialized in garbage eradication, such as seminar/opinion exchange and network, the group had increased knowledge, attitude, and problem-solving skill.

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

6.1 Research Results' Conclusion

The study on the development of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand aims to: 1) Find important factors that affect to people's participation in sustainable mangrove forest management on eastern coast of Thailand 2) Develop participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand 3) Evaluate participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand.

Study procedure consists of 3 steps as follows. The first step is the study on primary information by applying quantitative research in order to fine the fact of the problem and important factors that affect to people's participation in solving the problem. The second step is the development of environmental education model by applying qualitative research. Participatory action research (PAR) method was used to mobilize and integrate to create environmental education model. The final step is the arrangement of environmental education activity and evaluation of environmental education model to approve the newly-created environmental education model.

In the study on primary information, it was found that the responders, who lived in mangrove forest area in Chanthaburi, were mostly female 68.10% and male 31.90%. Their average age is 43 years (mean = 42.78). About education level of the samples, most of them graduated upper primary education (grade 4-6), accounted to 24.65%. They did prawn farms 22.22%. The average household income is 250,000 Baht per year (mean = 251,848.13). The average number of family members is 5 persons (mean = 4.52 persons). In addition, it was also found that most samples settled on the current area for 27 years averagely (mean = 27.02). The size of possessed land is about 10 rai (mean = 10.00).

About receiving the information about mangrove forest management, it was found that most samples, 95.80%, received the information about mangrove forest management mostly from television, 83.70%. It was also found that most samples were members of social groups, 60.40%. Most of them were members of community leader group, accounted to 43.68% from the samples who were members of all social groups.

About experience in mangrove forest management among the samples, 79.50% of them had experience. The average experience in mangrove forest management is 2 times (mean = 2.35). When ranged the level of experience in mangrove forest management, it was found that most samples had low level of experience, 42.00%.

Moreover, it was found that most samples, 188 persons (65.28%), had medium level of knowledge about mangrove forest management. The next group had high level of knowledge, 67 persons (23.26%). And the number of people with low level of knowledge is 33 persons (11.46%).

The best model appropriate for prediction of people's participation in mangrove forest management in Chanthaburi is 3rd model (full model). Independent variables are demographic attribute and socio-economic attribute. The coefficient is in raw score, consisting of constant coefficient 0.187, age coefficient 0.004, primary education coefficient (edu1) -0.323, secondary school coefficient (edu2) 0.030, mangrove forest management knowledge coefficient (totalknow) 0.169, period of settlement coefficient (located_period) -0.004, social group membership coefficient (status_term) 0.041, mangrove forest management (ex_activities) 0.382, agriculture coefficient (occupa1) -0.240, employee coefficient (occupa2) -0.308, trading coefficient (occupa3) -0.380, other occupations coefficient (occupa4) -1.268, household income coefficient (h_income) 0.011), and size of possessed land coefficient (area) 0.011. Prediction equation in raw score form can be drawn as follows.

amount of participation = 0.187 constant + 0.004*age – 0.323*(edu1) + 0.030*(edu2) + 0.169*totalknow - 0.004*located_period + 0.041*status_term + 0.382*ex_activities - 0.240*occupa1 - 0.308*occupa2 - 0.380*occupa3 - 1.268*occupa4 + 0.011*h_income + 0.011*area

In conclusion, from primary information, it was found that knowledge and understanding of mangrove forest management and experience in mangrove forest management are important factors that affect to people's participation in mangrove forest management in Chanthaburi. Most people have medium level of knowledge about mangrove forest management. They have experience in mangrove forest management averagely 2.35 times per year. The most appropriate group, which is the target of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand, is community leader group.

In the result of the development of participatory environmental education for sustainable mangrove forest management in Chanthaburi by stakeholders, it was found that **the most appropriate environmental education model for mangrove forest management on eastern part of Thailand** contained the procedures and compositions as follows.

1. About the objective of environmental education model, it was expected that the persons, who passed the workshop for sustainable mangrove forest management, must have good behavior toward mangrove forest management. This is due to knowledge about mangrove forest management, awareness of mangrove forest management, good attitude toward mangrove forest management, good problem-solving skill on mangrove forest management, evaluation ability on mangrove forest management in different projects, and participation in mangrove forest management. This is able to meet the objectives and policies of the government regarding to mangrove forest.

2. The curriculum contains the content about mangrove forest management. It opens the community to participate.

3. Activity procedure is the workshop focusing on participant's participation. Everyone is allowed to express their opinions freely under the rule and agreement of the group. Any agreements or rules are based on majority.

4. Evaluate to examine completeness of environmental education model.

5. The increase or addition of other special factors or conditions that support environmental education model, which is workshop for mangrove forest management, to become successful consist of:

5.1 Participation of the community in every process of the activity contained in environmental education for building the sense of ownership among the community

5.2 Characteristic or method to run the activity is not complex. It is compatible with community lifestyle.

5.3 The result of activity contained in environmental education model causes tangible benefits for the community.

5.4 Local administrative organization and local institute, such as temples, schools, public health centers, and police stations, support mangrove forest management.

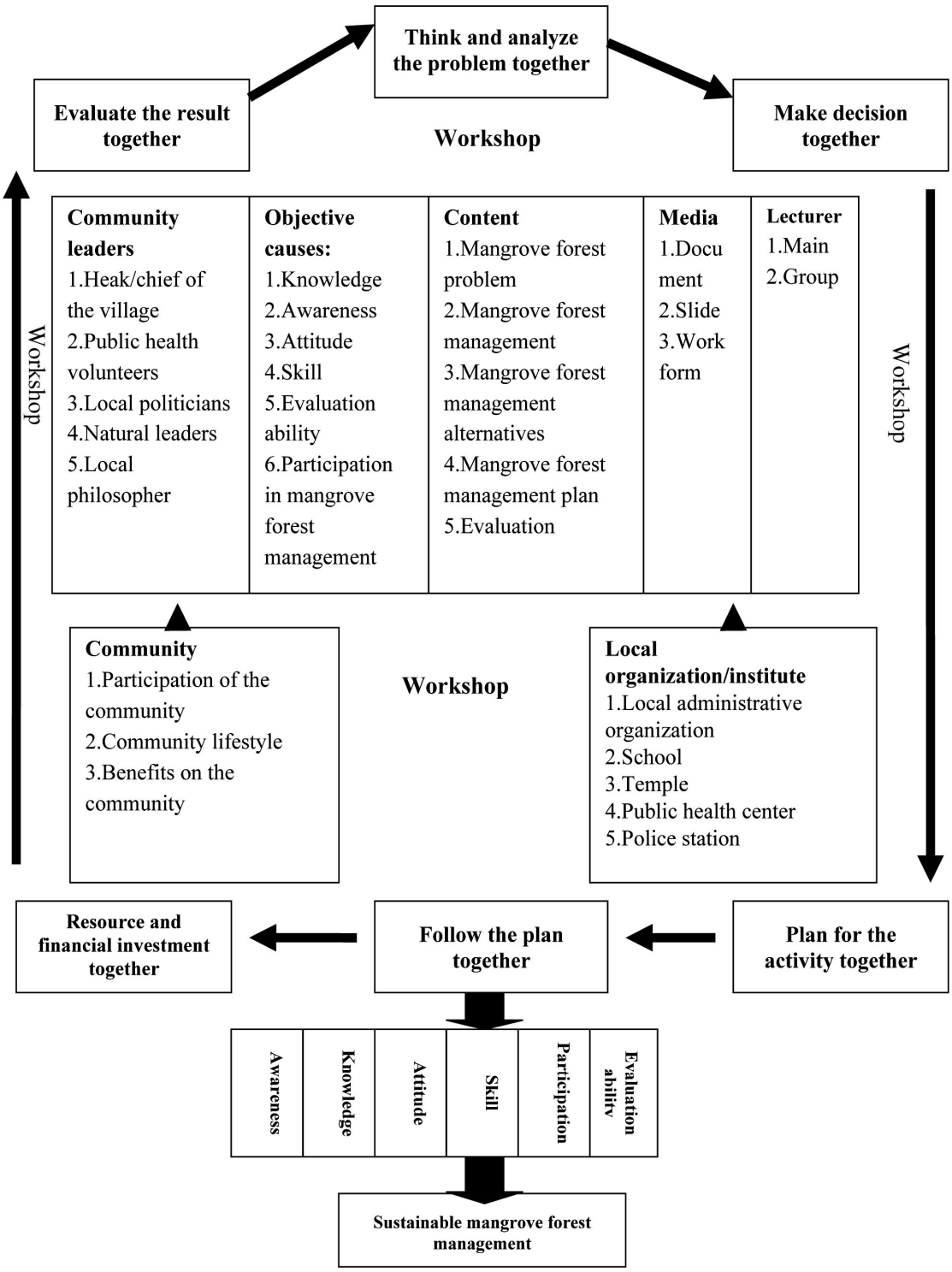

Figure 6.1 Completely Participated Environmental Education Model

About evaluation before and after workshop for sustainable mangrove forest management in Chanthaburi, the difference between knowledge about mangrove forest management before and after the workshop among 40 samples was found. Before the workshop the samples had average knowledge score 7.98. After the workshop, the average knowledge score was 8.45. The samples had increased knowledge at 0.48 score averagely, which is significant at the level of 0.05.

About the difference of attitude before and after the workshop among 40 samples, it was found that before the workshop the samples had average attitude score 37.12. After the workshop, the average attitude was 41.10. The samples had increased attitude at 3.98 scores averagely, which is significant at the level of 0.05.

About the difference of awareness before and after the workshop among 40 samples, it was found that before the workshop the samples had average awareness score 36.30. After the workshop, the average attitude was 40.93. The samples had increased awareness at 4.63 scores averagely, which is significant at the level of 0.05.

About the difference of problem-solving skill before and after the workshop among 40 samples, it was found that before the workshop the samples had average problem-solving skill score 35.58. After the workshop, the average problem-solving skill was 39.80. The samples had increased problem-solving skill at 4.23 scores averagely, which is significant at the level of 0.05.

About the difference of evaluation ability before and after the workshop among 40 samples, it was found that before the workshop the samples had average evaluation ability score 37.10. After the workshop, the average evaluation ability was 41.00. The samples had increased evaluation ability at 3.90 scores averagely, which is significant at the level of 0.05.

About the difference of participation before and after the workshop among 40 samples, it was found that before the workshop the samples had average participation score 4.13. After the workshop, the average participation was 5.65. The increase is significant at the level of 0.05.

The result showed that participatory environmental education model for sustainable mangrove forest management on eastern coast or the workshop for sustainable mangrove forest management in Chanthaburi was able to develop knowledge, attitude, awareness, problem-solving skill, and evaluation ability, as well as participation in mangrove forest management.

In conclusion, this research found that the important factors that affect to people's participation for mangrove forest management on eastern coast consist of knowledge and understanding in mangrove forest management and experience in mangrove forest management. This important characteristic of the target, which will be taken into participatory environmental education process for sustainable mangrove forest management, includes community leaders.

The development of participatory environmental education for sustainable mangrove forest management on eastern coast of Thailand contains these following important compositions.

1. The objective of environmental education expects that the persons that have completed the workshop for sustainable mangrove forest management must have good behavior toward mangrove forest management. This is due to knowledge about mangrove forest management, awareness of mangrove forest management issue, good attitude toward mangrove forest management, good skill in solving mangrove forest management issue, and able to evaluate mangrove forest management indifferent projects as well as participation in mangrove forest management. These are able to meet government objectives and policies in the area of mangrove forest management.

2. The curriculum contains the content about mangrove forest management that allows the community to participate.

3. Activity process is the workshop focusing on participants' participation. It allows everyone to express their opinions freely under the rule or agreement of the group. Any agreements or rules are based on the majority.

4. Evaluate to examine completeness of environmental education model.

5. The increase or addition of other special factors or conditions that support environmental education model, which is workshop for mangrove forest management, to become successful consist of:

5.1 Participation of the community in every process of the activity contained in environmental education for building the sense of ownership among the community

5.2 Characteristic or method to run the activity is not complex. It is compatible with community lifestyle.

5.3 The result of activity contained in environmental education model causes tangible benefits for the community.

5.4 Local administrative organization and local institute, such as temples, schools, public health centers, and police stations, support mangrove forest management.

About evaluation of participatory environmental education model for sustainable mangrove forest management, it was found that the knowledge, attitude, awareness, problem-solving skill, evaluation ability and participation in mangrove forest management before and after environmental education were different significantly. This implies that the developed environmental education model increased knowledge, attitude, awareness, problem-solving skill, and evaluation ability as well as participation in mangrove forest management.

6.2 Recommendations for Policy Formulation

1. From the research, it was found that community participation was important for mangrove forest management in the community. Therefore, the government should support or determine the police to allow the community to participate more in mangrove forest management at national level.

2. The government should plan or determine the policy to develop potential of community leaders in the area of mangrove forest management until they become local researchers.

3. In local mangrove forest management, local institute should take more roles by carrying on in the form of local mangrove forest management network.

6.3 Recommendations for Utilization of Research Results

1. Take community's regulation and plan derived from the operation according participatory environmental education for sustainable mangrove forest management into community institute in procedural form for acceptance of every sides in the community.

2. Community leaders, who have entered into the workshop, should use the knowledge for village meeting according to the process and procedure of participatory environmental education model for sustainable mangrove forest management in order to solve the community's mangrove forest management issue effectively with low cost.

3. Participatory environmental education model for sustainable mangrove forest management on eastern coast of Thailand can be applied for every region in eastern part. For the use in other places, one must consider on local conditions and uniqueness of the context.

6.4 Recommendations for Further Research

1. One should consider on other factors that affect to sustainable mangrove forest management beside from environmental education, such as government policy and management of responsible institute.

2. Create mangrove forest management curriculum for the students that live in mangrove forest area in order to maintain community mangrove forest.

3. Use non-formal environmental education model without participation of target group, especially popular television program.

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APPENDIX

Regression output of Eco – social model

Descriptive Statistics

	Mean	Std. Deviation	N
amount of participation	2.68	2.264	288
farming:fishery	.31	.461	288
employment:fishery	.21	.407	288
trade:fisnery	.07	.249	288
another career:fishery	.04	.200	288
h_income*10000	25.1848	16.30332	288
area	10.0096	8.63684	288

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	area , another career:fishery, trade:fisnery, farming:fishery, h_income*10000, employment:fishery[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: amount of participation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.040	6	14.507	2.946	.008[a]
	Residual	1383.571	281	4.924		
	Total	1470.611	287			

a. Predictors: (Constant), area , another career:fishery, trade:fisnery, farming:fishery, h_income*10000, employment:fishery

b. Dependent Variable: amount of participation

Regression output of ethnological model

Descriptive Statistics

	Mean	Std. Deviation	N
amount of participation	2.68	2.264	288
age	42.78	12.833	288
primary:college	.42	.494	288
secondary:college	.45	.498	288
totalknow	8.04	1.749	288
located_period	27.0208	18.06742	288
status_term	3.5417	3.50982	288
ex_activities	2.35	2.131	288

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	ex_activities, totalknow, age, status_term, secondary:college, located_period, primary:college[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: amount of participation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	286.824	7	40.975	9.692	.000[a]
	Residual	1183.787	280	4.228		
	Total	1470.611	287			

a. Predictors: (Constant), ex_activities, totalknow, age, status_term, secondary:college, located_period, primary:college

b. Dependent Variable: amount of participation

Regression output of full model

Descriptive Statistics

	Mean	Std. Deviation	N
amount of participation	2.68	2.264	288
age	42.78	12.833	288
farming:fishery	.31	.461	288
employment:fishery	.21	.407	288
trade:fisnery	.07	.249	288
another career:fishery	.04	.200	288
primary:college	.42	.494	288
secondary:college	.45	.498	288
h_income*10000	25.1848	16.30332	288
located_period	27.0208	18.06742	288
area	10.0096	8.63684	288
status_term	3.5417	3.50982	288
ex_activities	2.35	2.131	288
totalknow	8.04	1.749	288

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	totalknow, trade:fisnery, h_income*10000, age, ex_activities, another career:fishery, farming:fishery, status_term, secondary:college, area , employment:fishery, located_period, primary:college[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: amount of participation

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.468[a]	.219	.182	2.047	2.206

a. Predictors: (Constant), totalknow, trade:fisnery, h_income*10000, age, ex_activities, another career:fishery, farming:fishery, status_term, secondary:college, area , employment:fishery, located_period, primary:college

b. Dependent Variable: amount of participation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	322.640	13	24.818	5.924	.000[a]
	Residual	1147.971	274	4.190		
	Total	1470.611	287			

a. Predictors: (Constant), totalknow, trade:fisnery, h_income*10000, age, ex_activities, another career:fishery, farming:fishery, status_term, secondary:college, area , employment:fishery, located_period, primary:college

b. Dependent Variable: amount of participation

BIOGRAPHY

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