การพัฒนารูปแบบระบบนิเวศป่าไม้

Development of Forest Ecosystem Model

เศรษฐพงศ์ แพงจันทร์, ดร. นงนภัส เที่ยงกมล และดร. ฉัตรชัย เที่ยงกมล

บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์ เพื่อศึกษาเปรียบเทียบคะแนนเฉลี่ยของความรู้เรื่องการอนุรักษ์ระบบนิเวศป่าไม้ เจตคติที่ดีต่อสิ่งแวดล้อม และ ความตระหนักต่อปัญหาสิ่งแวดล้อม แรงบันดาลใจในการมีจิตสาธารณะ และพฤติกรรมในการอนุรักษ์ระบบนิเวศป่าไม้ ระหว่างก่อนและหลังอบรม และพัฒนานักเรียนระดับชั้นประถมศึกษาตอนปลายโรงเรียนกุดอ้อประชานุสรณ์ ตำบลลำพาน อำเภอเมือง จังหวัดกาฬสินธุ์ ให้สามารถเป็นวิทยากรที่จะนำความรู้ที่ได้รับจากการอบรมไปถ่ายทอดแก่ผู้อื่นและชุมชน ทดลองโดยใช้ การประชุมเชิงปฏิบัติการอย่างมีส่วนร่วมแบบพาอิก ที่บูรณาการด้วยการวิจัยเชิงคุณภาพการอภิปรายกลุ่มย่อย การประเมิน 3 ด้าน และ 4 ด้าน เพื่อประเมินการแสดงบทบาทสมมุติการเป็นวิทยากร เครื่องมือเป็นแบบสอบถาม กลุ่มตัวอย่างเป็นนักเรียนประถมศึกษาตอนปลายโรงเรียนกุดอ้อประชานุสรณ์ จำนวน 30 คน ได้จากการสุ่มตัวอย่างแบบเฉพาะเจาะจงตามเกณฑ์ที่กำหนด สถิติที่ใช้ในการวิเคราะห์ข้อมูลคือ Paired Sample t-test เพื่อเปรียบเทียบความรู้ก่อนและหลังการอบรม และ One Way ANOVA เพื่อเปรียบเทียบผลการประเมิน 3 ด้านและ 4 ด้านผลการวิจัยพบว่า คะแนนเฉลี่ยของความรู้การอนุรักษ์ระบบนิเวศป่าไม้ เจตคติที่ดีต่อสิ่งแวดล้อม ความตระหนักต่อปัญหาสิ่งแวดล้อม แรงบันดาลใจในการมีจิตสาธารณะเพื่อการอนุรักษ์แวดล้อมและพฤติกรรมการอนุรักษ์ระบบนิเวศป่าไม้ของนักเรียน และคะแนนเฉลี่ย หลังการอบรมสูงกว่าก่อนการอบรมอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 และพัฒนารูปแบบการถ่ายทอดความรู้แก่นักเรียนอื่น ๆ ระหว่างการอบรมมีการประเมิน 3 ด้านเพื่อประเมินการมีส่วนร่วมของผู้รับการฝึกอบรม พบว่า คะแนนเฉลี่ยการประเมินตนเอง การประเมินโดยเพื่อนและการประเมินโดยผู้อำนวยความสะดวก ในสถานการณ์ปัจจุบันและอนาคต แตกต่างอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 นอกจากนี้การประเมินคุณลักษณะการเป็นวิทยากรด้วยการประเมิน 4 ด้าน พบว่า คะแนนเฉลี่ย การประเมินตนเอง การประเมินโดยเพื่อนวิทยากร การประเมินโดยผู้ฟัง และการประเมินโดยวิทยากรผู้เชี่ยวชาญ ต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01

คำสำคัญ: การพัฒนา, รูปแบบระบบนิเวศป่าไม้, นักเรียนประถมศึกษา

Abstract

The research objectives were to compare the mean score between pretest and posttest of forest ecosystem conservation knowledge, environment awareness and forest ecosystem conservation. The quasi-experimental research was conducted with 30 primary school students of Kudoorprachanuson School, Lumpan Sub-district, Muang District, Kalasin Province in Thailand. The purposive sampling technique was used for sample selection based on criteria of public mind and commitment to participate in the whole research operation. The objectives were to compare the

mean scores between pretest and posttest of forest ecosystem conservation knowledge, environmental awareness, environmental attitude, inspiration of environmental conservation, forest ecosystem conservation behavior and to develop model of primary school student to be a trainer for knowledge transferring to others. Three Dimensional Evaluations were applied for determination the participation and Four Dimensional Evaluations were used for trainer role play evaluation. One-way ANOVA was used to analyze the mean scores difference of three and four groups. After Participation-Appreciation-Influence-Control (PAIC) process was implemented, the findings revealed the mean scores of environmental awareness, environmental attitude, inspiration of environmental conservation, forest ecosystem conservation behavior and training achievement were higher than pretest with statistical significance ($p < 0.01$ for all aspects). In present and future situations, mean scores were different with statistical significance ($p < 0.01$). Moreover Four Dimensional Evaluations, mean scores were different with statistical significance ($p < 0.01$).

Keywords: development, forest ecosystem model, primary school student

Introduction

The child right under the 18 years old is identified in Article 1 that "a human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier" in The United Nations Convention (Office of the United Nations Higher Commissioner for Human Rights, 2012). A child is biologically a human between the stages of birth and puberty. Some vernacular definitions of a child include the fetus, as being an unborn child. The legal definition of "child" generally refers to a minor, otherwise known as a person younger than the age of maturity. The age of maturity is the threshold of adulthood as it is declared in law. It is the chronological moment when minors cease to legally be considered children and assume control over their persons, actions, and decisions, in that way terminating the legal control and legal responsibilities of their parents or guardian over them. The enormous majority of countries set maturity at 18 years including Thailand set in some legal issues such as right to election but for law maturity is 20 years. However, childhood is the age span ranging from birth to adolescence. In developmental psychology, childhood is divided up into the developmental stages of toddlerhood, early childhood as play age, middle childhood or elementary school age, and adolescence. Middle childhood begins at around age seven or eight, resembling primary school age and ends around puberty, which typically marks the beginning of adolescence (Wikipedia, 2012; Cannella, and Kincheloe, 2002).

In company with traditional culture, Thai people has considered that child is similar to white clean cloth, therefore if one wants to cultivate trait or habit of environmental conservation behavior, one should establish immediately whenever child is ready to understand some theoretical concepts of environmental education principles and environmental management. The child with middle childhood might be suitable age for attitude adjusting, awareness raising, and behavior changing on environmental conservation regarding on forest ecosystem conservation, and environmental

conservation with public mind (Thiengkamol, 2009a; Thiengkamol, 2009b; Thiengkamol, 2011e) . Especially, the psychological development should be paid attentions for primary school age since it would be able to develop the learning ability to think and understand with theoretical thinking, and to develop self-awareness, self-image, self-esteem, self-control and independence, so if child has a successful experience, it would support him to accomplish self-confidence to practice as a good global citizen to take responsibility for environmental quality in future (Thiengkamol, 2011e; Thiengkamol, 2012a; Thiengkamol, 2012b). Even though, the temper or sentiment might be swung consistent with event and condition but the moral development might be idealism. Conversely, he can make an integrity of right or wrong (Ketuman, 2007; Thiengkamol, 2012b).

Particularly, Thiengkamol stated that the child is our hope of future generation with environmental ethics for environmental conservation through daily activities with public mind for family, school, society and country. In order to accomplish sustainable development, he must pay their attention to participate for environmental conservation anchored in public mind and responsibility for environmental management in school (Thiengkamol, 2011e; Thiengkamol, 2011i; Thiengkamol, 2012a; Thiengkamol, 2012b).

A forest is usually an area filled with trees but any tall densely packed area of vegetation may be considered a forest, even underwater vegetation such as kelp forests, or non-vegetation such as fungi, and bacteria. Tree forests cover approximately 9.4 percent of the Earth's surface (or 30 percent of total land area), though they once covered much more (about 50 percent of total land area). They function as habitats for organisms, hydrologic flow modulators, and soil conservers, constituting one of the most important aspects of the biosphere (Stamets, 2005). A forest ecosystem is a natural woodland unit consisting of all plants, animals and micro-organisms (Biotic components) in that area functioning together with all of the non-living physical (abiotic) factors of the environment. Forest ecosystem is one major ecologic unit that exists as "home" for a community of both indigenous or migrant, classified organisms. The forest ecosystem is just one of a number of unique ecosystems including prairies, deserts, Polar Regions and great oceans, smaller lakes and rivers. A forest ecosystem typically is connected with land masses covered in trees and those trees are often classified by foresters into forest cover types. Complex forest ecosystems are extremely diverse, ranging from dry desert shrub land to large temperate rain forests. Some ecosystems, like tundra, coral reefs, wetlands and grasslands are very fragile and very small changes can affect their continued existence. Larger ecosystems with wide diversity are much more stable and somewhat resistant to harmful alterations (Burton et al., 2003; Kimmin, 2004; Ruengpanich, 2003).

A forest ecosystem community is directly associated to species diversity. The more complex the structure is, the greater is its species diversity; therefore a forest community is much more than just the sum of its trees. A forest is a system that supports interacting units including trees, soil, insects, animals, and man. Naturally, forest ecosystems tend to always be moving toward maturity or into what it is called as a climax forest. This maturing, also called forest succession. The

ecosystem increases diversity up to the point of old age where the system slowly collapses. One forestry example of this is growth of trees and the entire system toward an old growth forest. When the ecosystem is exploited and exploitation is maintained or when components of the forest begin to naturally die, then the maturity of the forest ecosystem declines (Burton et al., 2003; Kimmin, 2004; Ruengpanich, 2003; Thiengkamol, 2009c).

Management of forests for sustainability is desirable when forest diversity is threatened by overuse, resource exploitation, old age and poor management. Forest ecosystems can be disrupted and harmed when not appropriately sustained. A sustained forest that is certified by a qualified certification program gives some assurance that the forest is managed to allow maximum diversity to meet sustainable development via forest conservation by all age people whether children, youths or adults to and while satisfy pro-environmentalist and economic demands (Burton et al., 2003; Kimmin, 2004; Ruengpanich, 2003; Thiengkamol, 2009c).

Thailand, there are some school occupied the forest neighboring the school, therefore administrators of school and community have the influence to protect these forest absolutely. The school administrators who comprehend to the importance of forest ecosystem would be concentrated to establish projects and activities to allow students take an essential part to study forest ecosystem and to support on forest ecosystem conservation. The projects and activities are detained by teachers and students with real pleasure would initiate them to have environmental consciousness and aware to protect school forest ecosystem with public mind because when they cultivate the tree and are careful the trees and others living creature whether tree, herb, mushroom, bird and so on. This would inspire them to love and share their feeling of dedicate mind to value the attractiveness and desirability of nature (Ruengpanich, 2003; Thiengkamol, 2009c; Thiengkamol, 2011e).

Environmental education is principally to clarify that people at present generation should have knowledge, understanding and solve the environmental problems correctly. Accordingly, any of their activities for living, it needs to consume the natural resources and they involve to the environmental quality, then they must take responsibility for any activities that they do with public mind to conserve the environment and natural resources honestly. Furthermore, they must have apposite behavior as pro-environmentalist with correct awareness and positive attitude to participate in environmental projects and activities alongside having sensitivity to realize the required environmental quality and practice to protect environment until it becomes a permanent habit and becomes a behavior to focus on sustainability of environmental quality without require rewards, money or admiration (Office of National Economic and Social Development Plan, 2010; Volker, 2007; Watkinson, 2009; Thiengkamol, 2005a; Thiengkamol, 2011e).

Kudoorprachanuson School locates nearby community forest at Lumpan District, Kalasin Province in Northeastern region of Thailand. The primary school students of Kudoorprachanuson School are young children who are important persons to take responsibility for forest protection and conservation. Therefore if they have public mind inspiration to conserve the school forest during they are studying in

this school. They would be our hope for country to conserve and manage school forest to meet sustainable development. However, they are recruited with criteria of willing to participate through training process and with commitment to devote themselves to be an educator or trainer for the others after participating in training like as Participation-Appreciation-Influence-Control (PAIC). They would gain more environmental knowledge and understanding with integration of forest conservation and environmental education principles to attain the sustainable school forest conservation. Environmental education proposes to produce knowledgeable citizen to concern the biophysical environment, to aware environmental quality and to take responsibility for environmental problem together with corrected decision making to solve environmental problem with clear understanding. Simultaneously, the projects and activities for school forest conservation need to be planed to conduct to create a environmental prototype with primary school students by Training of Trainer (TOT). PAIC incorporated with environmental education principles assisting to increase primary school student to deeply gain knowledge and understanding the biophysical environment at school forest via direct learning experience. Therefore, they would be to aware and concern for forest conservation with real learning lesson with school forest whether in terms of forest advantages in diverse perspectives of human four basic needs counting of food, drug, shelter and cloths. In addition, forest provides shadow, soil erosion prevention, humidity maintenance and ecological balance. Especially, once they feel appreciate the essence of school forest and together with challenging their public mind for environmental conservation, it would lead to change their behavior in daily life with responsibility for forest conservation. Finally, they will be future generation and our hope to assist to sustainably conserve forest (Thiengkamol, 2011e; Thiengkamol, 2011h; Thiengkamol, 2012a; Thiengkamol, 2012b; Langly, 1998, Sproull, 1988; InWent-DSE-ZEL,2002).

Therefore, the school forest conservation of Kudoorprachanuson School, Lumpan Sub-district Muang District, Kalasin Province, would be attained. The primary school student must be encouraged through project and activities that are supported by the school administrators and teachers in order to inspire them to realize through the effective training technique of PAIC process to gain more knowledge of forest ecosystem conservation, environmental awareness, environmental attitude, inspiration of environmental conservation, forest ecosystem conservation behavior to be trainer and educator to act as prototype for other students in this school with correctly practice as good role model for others students in this school and people in community as well (Thiengkamol, 2005a; Thiengkamol, 2009c; Thiengkamol, 2011e; Thiengkamol, 2011a; Thiengkamol, 2011h; Thiengkamol, 2012a; Thiengkamol, 2012b).

Objective

The objectives were to compare the mean scores between pretest and posttest of knowledge of forest ecosystem conservation, environmental awareness, environmental attitude, inspiration of environmental conservation, forest ecosystem conservation behavior and to develop model of primary

school student to be a trainer for knowledge transferring to others.

Conceptual Framework

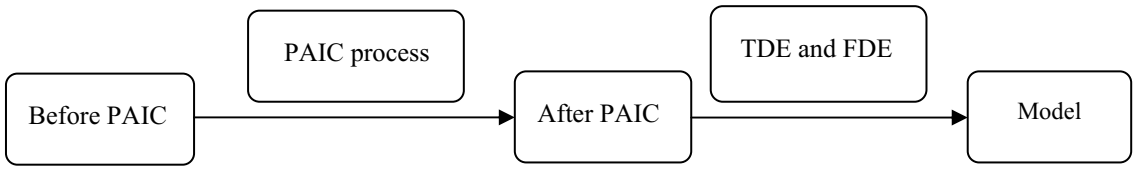

Figure Conceptual Framework

Methodology

The research design was conducted with steps by step as the followings**.**

Population and Sample

Population was 515 primary school students of Kudoorprachanuson School, Lumpan Sub-district, Muang District, Kalasin Province in Thailand. The purposive sampling was used to select 30 primary school students with criteria of willingness, time, devotion, commitment, and public mind.

Research Tool

The handbook was constructed knowledge of forest ecosystem conservation, environmental awareness, environmental attitude, inspiration of environmental conservation, and forest ecosystem conservation behavior (InWent-DSE-ZEL, 2002; Ruengpanich, 2003; Thiengkamol, 2009c; Thiengkamol, 2011a; Thiengkamol, 2012a). The questionnaire composed of 6 items of demographic characteristics and 40 questions of with 5 rating scales of knowledge of forest ecosystem conservation, environmental awareness, environmental attitude, inspiration of environmental conservation, and forest ecosystem conservation behavior. The content and structural validity were determined with Item Objective Congruent (IOC) by 5 experts in the aspects of psychology, social science and social research methodology (Rovinelli & Hambleton, 1977). The reliability was done by collecting the sample group from 30 high school of adjacent school. The reliability was determined with Cronbach's Alpha (Cronbach, 1951). The reliability of knowledge of forest ecosystem conservation, environmental awareness, environmental attitude, inspiration of environmental conservation, and forest ecosystem conservation behavior were 0.912, 0.908, 0.911 and 0.916 respectively. The evaluation form of Three Dimensions, Four Dimensions were used to assess the participant practice and role play as trainer during PAIC implemented (Langly, 1998, Sproull, 1988; In Went-DSE-ZEL., 2002; Thiengkamol, 2012a; Thiengkamol, 2012b).

Data Collection

The questionnaire was used for data collecting from 32 primary school students of Kudoorprachanuson School. The Three Dimensional Evaluation (TDE) was used to examine the congruence of three aspects evaluation, Self-evaluation, Friend-evaluation, and Facilitator-evaluation for training

participation. The Four Dimensional Evaluation (FDE) was employed for trainer role play (Thiengkamol, 2011a; Thiengkamol, 2011g; Thiengkamol, 2011h; Thiengkamol, 2011e).

Statistical Analysis

1. The descriptive statistics were used that include frequency, percentage, mean and standard deviation.

2. The inferential statistics used was paired t-test and by considering confident interval at 0.05 and 0.01. One-way ANOVA was used to determine the mean scores difference of three and four groups.

Results

The results of this study for primary school students of Kudoorprachanuson School, Lumpan Sub-district, Muang District, Kalasin Province in Northeastern region of Thailand, were as the followings.

1. General Characteristics of Sample Group

The sample group of this study was 30 primary school students of Kudoorprachanuson School, Lumpan Sub-district, Muang District, Kalasin Province in Northeastern region of Thailand in the year of 2013. The selected sample was primary school students of Kudoorprachanuson School who were elected to be trained for knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior. Most of them were male with 16 (53.30%), had age between 9-12 years old with mean of 10.33 years, had education level at primary school level 3 with 10 (33.34%), had family characteristics with nuclear family of 25 (83.30%), and lived with parents with 28 (93.30%).

2. Results of Pretest and Posttest with PAIC technique

PAIC technique was trained for 30 primary school students of Kudoorprachanuson School about knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior. The research results discovered that before and after PAIC training process implemented, the mean scores of posttest of training achievement on knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior and training achievement were higher than pretest with statistical significance ($p< 0.01$) for all aspects, as presented in table 1.

Table 1

Pretest and Posttest of Sample Group

Training Issues	Posttest		Pretest		t	p
	$\overline{X}$	S.D.	$\overline{X}$	S.D.		
Knowledge of Forest Ecosystem Conservation	43.90	3.99	40.80	3.68	7.55	0.000**
Attitude toward Environment	47.40	3.30	44.20	3.27	7.49	0.000**
Awareness to Environmental Problem	46.13	3.36	43.23	3.55	7.92	0.000**
Inspiration of Public Mind	44.80	5.34	41.27	5.32	8.47	0.000**
Forest Ecosystem Conservation Behavior	47.87	3.18	41.40	5.97	6.00	0.000**
Training Achievement	46.02	3.26	42.18	3.58	9.27	0.000**

** Significant Level at 0.01

3. Results of Three Dimensional Evaluations for Participation in Present Situation

Three Dimensional Evaluations were used for investigation the participations of 30 primary school students in three aspects evaluation of Self-evaluation, Friend-evaluation, and Facilitator-evaluation in present situation with One-way ANOVA Analysis to investigate the mean score differences of three groups. The results of One-way ANOVA illustrated that there were different mean scores about participation in training process with statistical significance ($p<0.01$) as presented in table 2.

Table 2

Three Dimension Evaluation of Sample Group for Participation in Present Situation

Source of Variation	Sum of squares	df	Mean Square	F	Sig.
Between Groups	3.55	2	1.78	29.24	0.000**
Within Groups	5.28	87	0.06		
Total	8.84	89			

** Significant Level at 0.01

The Scheffe was used for comparison of each pair of Three Dimensional Evaluation (TDE) to determine the mean score differences of their participation in the training process of PAIC, it showed that Self-Evaluation and Friend-Evaluation, and Self-Evaluation and Facilitator-Evaluation had statistically significant at level of 0.01, and 0.01 as demonstrated in table 3.

Table 3

Scheffe' Analysis of Each Pair Comparisons in Present Situation

Evaluation	$\overline{X}$	Self-valuation	Friend Evaluation	Facilitator Evaluation
		4.10	4.52	4.53
Self-Evaluation	4.10	-	-0.41	-0.43
			(0.000)**	(0.000)**

** Significant Level at 0.01

4. Results of Three Dimensional Evaluations for Participation in Future Situation

Three Dimensional Evaluations were employed for determination the perceptions of 30 primary school students in three aspects evaluation of Self-evaluation, Friend-evaluation, and Facilitator-evaluation in future situation with One-way ANOVA Analysis to investigate the mean score differences of three groups. The results of One-way ANOVA showed that there were different mean scores about participation in training process with statistical significance ($p<0.01$) as presented in table 4.

Table 4

Three Dimension Evaluation of Sample Group for Participation in Future Situation

Source of Variation	Sum of squares	df	Mean Square	F	Sig.
Between Groups	1.14	2	0.57	5.79	0.00**
Within Groups	8.56	87	0.10		
Total	9.70	89			

** Significant Level at 0.01

The Scheffe was used for comparison of each pair of Three Dimensional Evaluation (TDE) to determine the mean score differences of their participation in the PAIC training process, it illustrated that Friend-Evaluation and Facilitator-Evaluation had statistically significant at level of 0.01 as showed in table 5.

Table 5

Scheffe' Analysis of Each Pair Comparisons in Past Situation

Evaluation	$\overline{X}$	Self-valuation	Friend Evaluation	Facilitator Evaluation
		4.60	4.53	4.79
Self-Evaluation	4.60	-	-	-
Friend Evaluation	4.53	-	-	-0.266
				(0.01)**

** Significant Level at 0.01

5. Results of Four Dimensional Evaluations for Trainer Role Play

Four Dimensional Evaluations were employed for determination the trainer role play in four aspects evaluation of Trainer self-evaluation, Trainer friend evaluation, Audience evaluation and Expert trainer evaluation by using One-way ANOVA Analysis to analyze the mean score differences of four groups. The results of One-way ANOVA illustrated that there were different mean scores about trainer role play during PAIC with statistical significance ($p<0.01$) as presented in table 6.

Table 6

Results of Four Dimensional Evaluations for Trainer Role Play

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.72	3	5.91	88.34	0.00**
Within Groups	10.43	156	0.07		
Total	28.14	159			

** Significant Level at 0.01

The Scheffe was used for comparison of each pair of Four Dimensional Evaluation (FDE) to determine the mean score differences of their trainer role play in the PAIC training process, it illustrated that Trainer Self-valuation and Trainer Friend- Evaluation, Trainer Self-valuation and Audience Evaluation, Trainer Self-valuation and Expert Trainer Evaluation, Trainer Friend Evaluation and Audience Evaluation, and Trainer Friend- Evaluation and Expert Trainer Evaluation had statistically significant as demonstrated in table 7.

Table 7

Scheffe' Analysis of Each Pair Comparisons in Trainer Role Play

Evaluation	$\overline{X}$	Trainer Self-valuation 3.81	Trainer Friend-Evaluation 4.05	Audience Evaluation 4.70	Expert Trainer Evaluation 4.72
Trainer Self-valuation	3.81	-	-0.24 (0.040)*	-0.88 (0.000)**	0.90 (0.000)**
Trainer Friend- Evaluation	4.05	0.24 (0.040)*	-	-0.64 (0.000)**	-0.66 (0.000)**

** Significant Level at 0.01

During the PAIC training operated, focus groups discussion and brain storming were integrated, therefore, it is noticeable that they had a very excellent participation and they were able to fluent their idea and give explanation to their friends in the small group discussion. Subsequently, they were able to play role as trainer effectively. Especially, in small group discussion they cheerfully participated and were able to use their own imagination to draw their own idea and correspond their thinking to propose some projects to conduct after PAIC training. Additionally, they planned to share their knowledge and understanding getting from PAIC process to other students and plan to be act as trainer for other students in the school with public mind for forest ecosystem conservation.

Discussions

The results illustrated that the primary school student participants had knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior after participating in the PAIC training process. These were related to different studies of Thiengkamol, (2011g, 2011h, 2012b) and her colleagues (Morrasri, et al., 2012a; Ngarmsang, et al., 2012a; Gonggool, et al., 2012a; Phinnarach, et al., 2012a; Chaisena et al., 2013). It might implied that the training with PAIC technique is capable to raise knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior after take part in the PAIC training via actual practice in their daily life activities to gain more knowledge of school forest conservation, environmental education included arise awareness, attitude change, and participate in knowledge of forest ecosystem conservation, attitude toward environment, awareness to environmental problem, inspiration of environmental conservation, and forest ecosystem conservation behavior. The results are also pertinent to the different studies of Thiengkamol, (2011a, 2011g, 2011h, 2011i, 2011j, 2012a, 2012b) and Thiengkamol colleagues researches of Mongkonsin, et al., 2013a; Pusdorn et al., 2013; Moolmanee et al., 2013; Chaisena et al., 2013; that the participation is affected to practice for different issues such as health care, flood response, and environmental conservation with public mind to achieve the genuine sustainable development via environmental education process.

Results of FDE of 30 participants were employed for determination of the equivalence of three aspects evaluation of Self-evaluation, Friend-evaluation, and Facilitator-evaluation. The mean scores three aspects were difference among three aspects in present and future situations ($p<0.01$, and $p<0.01$). This might be explained that participants are the primary school students who are modest persons so their mean score both in self-evaluation and friend-evaluation are lower than facilitators. Additionally, FDE was used to evaluate the trainer role play of primary school student participants; it was revealed that the mean scores of Trainer-self evaluation, Trainer-friend evaluation, Audience evaluation, and Expert trainer evaluation were statistically significant at level of 0.01. The result of training was pertinent to diverse studies of Thiengkamol, (2005a, 2010b, 2011g, 2011h, 2012a, 2012b) and researches of Thiengkamol colleagues such

as Ngarmsang, et al., 2012a; Sangsan-anan, et al., 2012b.

Additionally, it was found that PAIC training is useful for training with integration of brain storming process to develop a shared vision, action plan and projects in different issues of training such as urban community food security management, environment and natural resource conservation, elderly health care, dust self-prevention, and environmental conservation of food stand entrepreneur including other issues such as environmental conservation of agriculturist, biodiversity conservation, environmental conservation of disability student, environmental education tourism and holistic tourism management (Thiengkamol, 2011a; Thiengkamol, 2011g; Thiengkamol, 2011h; Thiengkamol, 2012a; Thiengkamol, 2012b; Pusdorn et al., 2013; Moolmanee et al., 2013; Chaisena et al., 2013; Ngarmsang, et al., 2012a; Sangsan-anan, et al., 2012b).

Moreover, the results of training achievement was similar to numerous studies of Thiengkamol, (2010b, 2011g, 2011h, 2012a, 2012b), and Thiengkamol colleagues included Phinnarach, et al., 2012b; Sangsan-anan, et al., 2012b; Pusdorn et al., 2013; Moolmanee et al., 2013; Chaisena et al., 2013; Mongkonsin, et al., 2013a. This implies that its research process with PAIC implementation can be applied to operate in other school which has the forest area in school or nearby school to reproduce this training model to train the primary school student with the similar training manual and process.

References

Cannella, G. & Kincheloe., J. L. (2002). *Kidworld: Childhood studies, global perspectives, and education.* New York: Peter Lang.

Chaisena, K., Thiengkamol, N. & Thiengkamol, C. (2013). Environmental conservation promotion for food stand entrepreneur. *European Journal of Scientific Research*, *104*(4), 603-613.

Cronbach, J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(1), 297-334.

Fisher, R. (1995). *Collaborative management of forests for conservation and development*. Gland, Switzerland: IUCN and WWF.

Gonggool, D., Thiengkamol, N. & Thiengkamol, C. (2012a). Development of environmental education volunteer network through PAIC process. *European Journal of Social Sciences*, *32*(1), 136-149.

InWent-DSE-ZEL. (2002). *Regional training course "Advanced training of trainer".* Grand Jomtien Palace. Pattaya City. Thailand.

Ketuman, P. (2007). *Adolescent development.* Retrieved from: http://www.psyclin.co.th/new_page_56.htm

Moolmanee, C., Thiengkamol, N. & Khoowaranyoo, T. (2013). Self-health prevention from dust impact of the village health volunteer. *European Journal of Scientific Research, 104*(4), 592-602.

Mongkonsin, C. Thiengkamol, N. & Thiengkamol, C. (2013a). Development of flood disaster model through PAIC process. *Mediterranean Journal of Social Sciences, 4*(1), 559-567.

Morrasri, P., Thiengkamol, N. & Thiengkamol, T. (2012a). Development of little green child model through PAIC process. *European Journal of Social Sciences*, *34*(1), 78-87.

Ngarmsang, K., Thiengkamol, N. & Thiengkamol, C. (2012a). Development of an environmental education prototype of learning disability student through PAIC process. *European Journal of Social Sciences, 32*(2), 178-186.

Office of the United Nations Higher Commissioner for Human Rights, (2012). *What are human rights?*. Retrieved from http://www.ohchr.org/EN/Issues/Pages/WhatareHumanRights.aspx.

Office of National Economic and Social Development Plan. (2010). *The tenth national economic and social development plan B.E. 2550-2554*. Retrieved from http://www.nesdb.go.th/Default.aspx?tabid=90

Phinnarach, K., Thiengkamol, N. & Thiengkamol, C. (2012b). Development of community strength with healthy self-care model through PAIC process. *European Journal of Social Sciences, 34*(4), 549-558.

Burton, P. J., Messier, C., Smith, D. W. & Adamowicz, W. L. (2003). *Towards sustainable management of the boreal forest*. Canada: NRC Research Press.

Pusdorn, A., Thiengkamol, N. & Khoowaranyoo, T. (2013). Elderly self Health care in Roi Et Province. *European Journal of Scientific Research*, *104*(4), 569-579.

Rovinelli, R. J. & Hambleton, R. K. (1977). On the use of content specialists in the assessment of criterion-referenced test item validity. *Dutch Journal of Educational Research*, *2*(1), 49-60.

Ruengpanich, N. (2003). *Ecology and natural resources. Bangkok*: Kasetsart University.

Sangsan-anan, S., Thiengkamol, N. & Thiengkamol, C. (2012b). Development of sustainable tourism model through PAIC process. *European Journal of Social Sciences, 33*(3), 481-489.

Sproull, N. L. (1995). *Handbook of research method: A Guide for practitioners and scientific teachers in the social science.* (2nd edition). Metuchen, NJ: Scarecrow Press.

Stamets, P. (2005). *Mycelium Running.* Berkeley, CA: Ten Speed Press.

Sunderlin, W. D., Angelsen, A., Belcher, B., Burgers, P., Nari., R., Santoso, L. & Wunder, S. (2005). Livelihoods, forests, and conservation in developing countries: An overview. *World Development, 33*(1), 1383-1402.

Thiengkamol, N. (2005a). Strengthening community capability through the learning network model for energy conservation. *Journal of Population and Social Studies, 14*(1), 27-46.

Thiengkamol, N. (2009c). *Environment and development book 2.* Bangkok: Chulalongkorn University Press.

Thiengkamol, N. (2011a). *Holistically integrative research*.(2nd edition). *Bangkok:* Chulalongkorn University Press.

Thiengkamol, N. (2011e). *Environment and development Book 1.* (4th editon).Bangkok: Chulalongkorn University Press.

Thiengkamol, N. (2011g). Development of energy security management for rural community. *Canadian Social Science,* 5(5), 55-60.

Thiengkamol, N. (2011h). Development of a food security management model for agricultural community. *Canadian Social Science, 7*(5), 61-70.

Thiengkamol, N. (2012a). Development of a prototype of environmental education volunteer. *The Social Sciences, 7*(1), 77-82.

Thiengkamol, N. (2012b). Development of food security management for undergraduate student Mahasarakham University. *European Journal of Social Sciences, 27*(2), 246-252.

Volker, H. (2007). *Brundtland Report: A 20 years update*. Retrieved from http://www.sd-network.eu/pdf/doc_berlin/ESB07_Plenary_Hauff.pdf

Watkinson, J. (2009). *Will we ever take the environment seriously?*. Retrieved from http://myliberaldemocratpoliticalramblings.wordpress.com/2009/08/27/wced-1987-copenhagen-2009-will-we-ever-take-the-environment-seriously/

Wikipedia. (2012). *Child.* Retrieved from http://en.wikipedia.org/wiki/Child