

A Model of Environmental Education Competency Development for Teachers in Secondary Schools

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ABSTRACT

This research was to create a model of environmental education (EE) competency development for teachers in secondary schools, which has been conducted by the multi-research method. The data were collected by questionnaire for the operational teachers in eco-schools, and structured interview for the experts from teacher advisors, and the mentor teachers of the eco-school project, which analyzed by percentage, mean score, standard deviation, weight mean score, and index of congruence. The research findings revealed that most informants were having intermediate level of EE competency in 6 parts: environmental knowledge, fundamental understanding on EE, responsibility on EE teacher actualization, EE planning and operating, promoting of EE learning, and EE evaluation. The EE innovation was created to develop the teachers from various subjects to perform the integrated learning for the student's environmental actualization before conserving or solving the community environmental problems. This systematically consisted of 5 steps including: analyzing the environmental policy covering national, educational area, and school policies; studying the community environmental problem; designing the environmental learning project; identifying the learning standard; and performing the integrated lesson plan. The innovation efficiency was confirmed both internal and external skills by authentic assessment.

Keywords: environmental education, multidisciplinary integrated learning, teacher development

INTRODUCTION

Environmental education is involving policies that is lacking clear guidelines and practices. By deciphering environmental education in schools, the problem of environmental teaching in schools was associated to “teachers” because teachers created classrooms through learning plans. Therefore, one should employ EE teachers as leaders of the classroom facilitator. However, the successful growth of the EE processes was that “all school personnel must understand the importance of operating with the community” and looked at the development of learning procedures in EE to connect the community with the school. Through the process of instilling a greater consciousness of the issues for children was found most effective not only in schools, but in the community. This achieved concrete and on-going sustainable management and solution of environmental problems in the community (Department of Environmental Quality Promotion, 2015).

The international educators have put together two guiding principles for the EE teaching: learning about the environment provided students with an understanding of the work of natural and environmental systems and the impact of people's activities. Learning in the environment was to furnish students with hands-on experience in nature, and its intent was to integrate all learning materials for environmentally beneficial practices and real-life situations. The Committee of North American Association of Environmental Education

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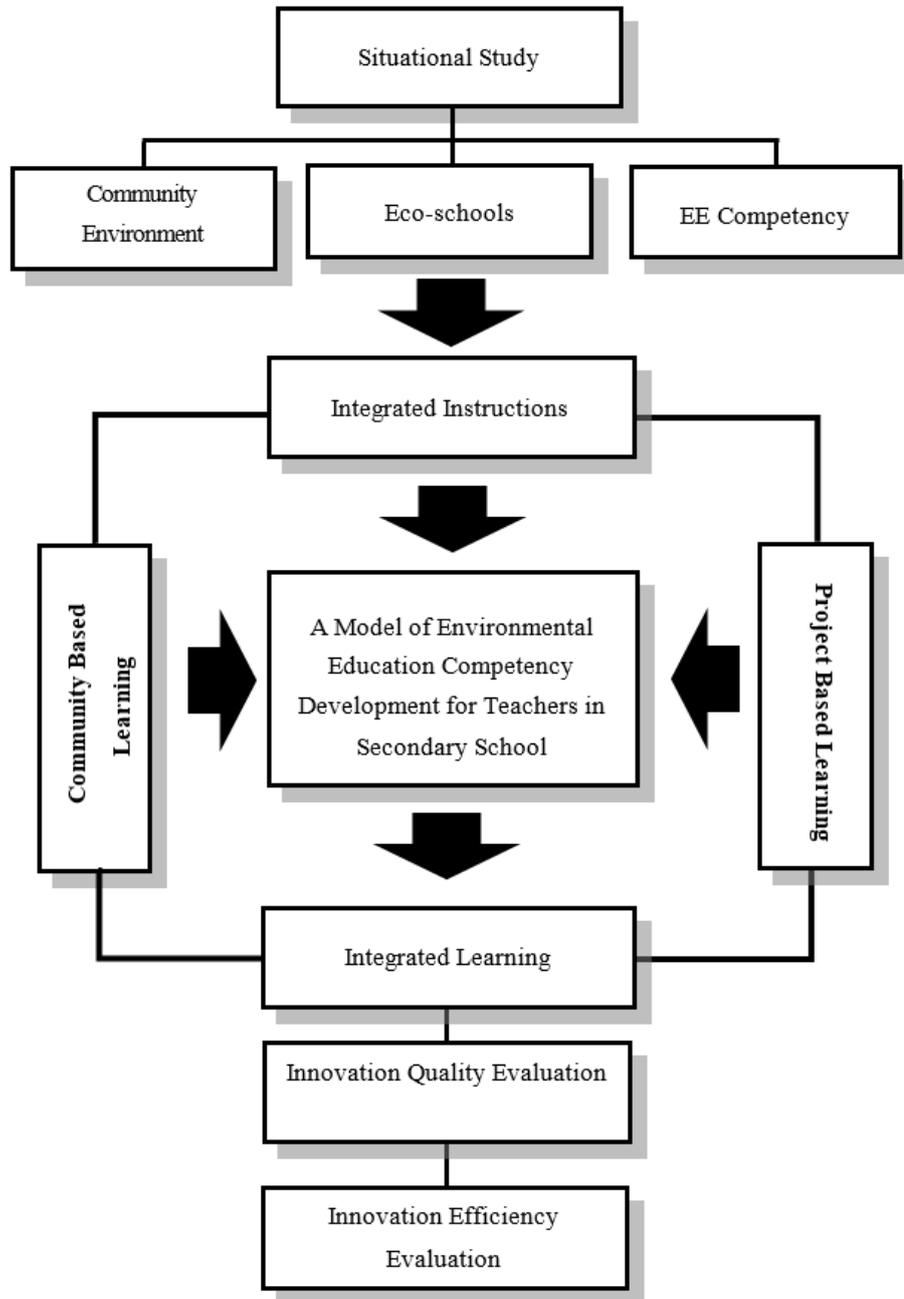


Figure 1. Research Conceptual Framework

– (NAAEE) has determined the core competency for students in the graduate diploma in teacher profession of EE as six performances of framework development: environmental knowledge, basic EE, teacher responsibilities, planning and operations, promoting EE, and measurement and evaluation of EE. Through the problems that led to the research, it was found that teachers played an important role for EE in schools, and needed further training. Therefore, the framework of competency development or desirable skills of EE teachers must be developed to be clear and enhance the teacher’s ability to facilitate the implementation or to furnish students with appropriate and sustainable learning experiences effectively. This research had the primary purpose of developing a model of EE competency for teachers in secondary schools with three specific objectives: to study environmental performance of secondary school teachers, to synthesize a model of the development of EE for secondary school teachers, and to evaluate the quality and efficiency of the model for the development of EE for teachers in secondary schools.

Likewise, the model of environmental teaching for teachers should be the integration of EE into the content and process in eight learning areas: art, Thai language, mathematics, sciences, social studies religion and culture, health and physical education, occupations and technology, and foreign language (Ministry of Education, 2008), which combining the content of the subjects in the same unit, using research activities to solve problems in appropriate situations (Hopkins, 1973, p. 21-22), and allowing students to research or study in the field of interest by collaborating with students and teachers. The characteristics of the integrated curriculum needed to have enough time for the students to learn and find out their varied interests. An autonomous study of remedial education was the foundational knowledge for students under the guidance of the teacher, and helped teachers to discover the abilities and interests of students offering them an opportunity to develop their skills. (Blishen, 1969, p. 27). The integrated curriculum focused on the core of the various subjects and various skills together. It emphasized the relationship between concept, content, and skills in each subject (Fogarty, 2002; Fogarty and Stoehr, 1995, p. 23-40). Therefore, this model of EE competency for teachers in secondary schools has culminated based on three concepts: multidisciplinary instruction, community-based learning (CBL), and project-based learning.

METHOD

This research was conducted with a model of manifold research methods, which covered both quantitative research and qualitative research. The research procedure consisted of three stages:

- Studying the EE competency of the teachers in secondary schools from six regions of Thailand for designing the new system, which used mixed methods as part of survey research through questionnaires, collecting data from 408 teachers who have been involved in environmental activities and projects for secondary schools, and in-depth structured interviews by using forms for data collected from the 19 mentor teachers from nine Eco-schools, and the Director of the EE Sector, Department of Environmental Quality Promotion, Ministry of Natural Resources and Environment.
- The design for the model of EE competency for secondary school teachers, used research and development (R&D) to synthesize the new approaches to environmental for secondary school teachers.
- For evaluating the efficiency of the new approach, an Innovation Quality Evaluation Form was used to collate the data for quality assessment of these innovations from the experts in experimental design by training the 30 teachers from eight learning areas on process of the model, and authentic assessment records were used to collect the data from teachers, consisting of observation, interviews, and evaluation of their works.

RESULT

Studying Current EE Competency of Teacher in Secondary Schools

The research findings reveal that consists of female teachers (73.28%), more than 50 years old for most of the professional level teachers (35.54%), graduated with a bachelor degree (65.69%), science teachers (44.36%) who participate in activities / environmental training project 1-2 times/semester, and participate in activities / environmental training project 1 time/ academic year. The EE competency characteristic it shows the ability of secondary school teachers to integrate EE with a variety of learning areas in six aspects. According to **Table 1**, the research findings revealed were different that most informants had the knowledge about environment, the planning and practice about EE, the promotion learning about EE, the based understanding about environment, responsibility, and also the evaluation about EE respectively.

The most informants can apply them to accord with EE issues. They select the sources of EE, which are correct and reliable source learning; they have the relationship which are human, education, and the results of ecological consequences. They have the knowledge and understanding about the historical areas of biology and local culture, followed by a variety of biological issues, biological change by their planning and management that link to the civil rights and the responsibility. A subsequent approach was produced with regards to environmental issues, then they researched and valuated to the various choices for solving problems respectively.

The most informants understood the goal, objectives, and the basis for EE, followed by knowing about the departments/ organizations which manage in the study of EE. They explain the current state of EE, respectively. Accordingly, the total averages for EE competency levels of basic knowledge in EE were moderate.

The most informants use the teaching method which determines real practice, then determines teaching, materials and instruction media to promote the learners to get the point of view. New views are supporting their beliefs and a self-assessment to create a plans/ activities for their professional development in the past, present and future. Following their explanations and examples comparing the difference between propaganda and education, they respectfully presented the academic work in committee meetings for a variety of activities and communication with the local community that link inquiry-based approaches to the academic standard of province level and national level respectively.

The research findings revealed that ten aspects of levels of competency for secondary school teachers in the plan and practical EE were different. Most informants support and promote the effort of EE teachers, and choose the appropriate technologies and instruments for teaching with learning. They use the appropriate EE with teaching methods for natural subjects, and choose the instrumental media from community, organization, professional training curriculum development, and/ or internet for the learners appropriately and consistently. They analyze the environmental problems of the learners and use the contents of teaching methods appropriately, and they understand the concept of content knowledge and skills including to the order of learners' development and the consistency skills with the curriculum, followed by the integration of EE subjects to link with main curriculum, sub-curriculum, and the school missions. Subsequently they provide the field experience to link the contents with learner's environment, and make appropriate teaching methods consistent with the variety of the learners in consideration of the various differences of background in culture, social economy, age and educational level, special needs, developmental abilities. This leads to life-long learning of the learners respectively.

Research in EE competency in the promotion of EE learning. Most informants take advantage of an appropriate time to teach by being flexible and open-minded in asking and answering questions of the learners, then they succeed in inducing them to learn and provide investigative experience for the learner's development appropriately. They succeed in stimulating and promoting interest in the environment among learners respectively.

EE competency in the evaluation of EE. Most informants apply the evaluation to improve teaching. They use the evaluation to determine the teaching methods that followed by the basis environment by using at least two tools to evaluate the knowledge, emotions and skills. This are consistent with the teaching objectives for the method to determine the learner's expectation for learning and evaluating on their own, then, they use the methods of the assessment for planning, the methods of using the assessment during the curriculum to improve the EE curriculum.

In addition, the results of the interviews, it could be the supporting data for model developing, which could be summarized in four items as:

Problem situation and the limitations on the activities/ EE projects in schools, which were the EE for sustainable development. The environmental policy and structural management as a mission. This was relevant with school administrators of determination in policy, vision, and clear EE management structure to lead to practice in the schools and community. The researcher had observed that many EE schools for sustainable development could not operate in accordance with the policy of EE schools for sustainable development, because the school administrators lacked the understanding of EE. Therefore, it was policy change management, which did not provide for the EE management in schools. The learning process was focused on teacher development and promoting in various EE learning by focusing on learning management. This was linked to the issues of natural resources and environmental local based on the concept of process learning "ABOUT" learning environment "IN" environment and learning "FOR" by using problem-based learning instead of coaching. The researcher had observed that teachers did not understand the goals of EE, which focused on developing citizens for sustainable development, so it was needed for promotion for the competency of Social teachers. This could allow the teachers to provide the EE activities without feeling that EE activities where the load of the work of learning management. Natural and environmental management in schools was promoting the idea of outdoor teaching instead of traditional classroom teaching. This was done by using the resource center in schools and communities. But still most activities were done in classrooms. Participation and networking of EE would provide the opportunities for parents, communities, and other departments or various organizations participate and support in the school management, built the learning resources within the school by focusing on the participation.

Factors of the promoting EE in schools. The teachers must know their own communities to be able to use the benefits that the local community can provide. This can, again, give the teacher an advantage when it

comes to teaching geography, climate, ecological characteristics impact of the area. The school administrators must promote and support for curriculum development that it has to be flexible and consistent with school policy. This was done in cooperation between the administrators and teachers. They had to do a SWOT together to analyze the strengths and weaknesses of the school, such as the school was distinctive point in the environment. Thus, the direction of a school's policy must promote and support the students to have the moral based on sufficiency economy philosophy through the EE process, etc.

Important contents of promoting competency for secondary school teachers in EE that needs to be successful in the integrated environmental curriculum. All teachers, administrators, and supervisors needs to meet to address and solve problematic topics. Therefore, the curriculum development based on the PDCA (Plan-Do-Check-Act) process to begin the stages to create the curriculum learning. This will make sure that the process is flexible and changeable.

Important components of competency in secondary school teacher's development. It was important for teachers who were interested in the environment to understand and EE integrated into learning activities in accordance with the standards of the Office of National Education Standards. Teachers must know the seven stages of EE: choose a situation or a learning issue, provide a knowledge base, analyze the link relationship, study the options and make various choices, planning design, training and practice, and share experience. Community-based learning is the knowledge about local community, geography, climate, ecological characteristics and ecology of the area, using the benefit of resources in the ecology, and the impact of the problem in the community. Problem-based learning is the knowledge about the problems of communities and use these problems to set up learning programs for children. This was done by following a plan that made the children do tasks to solve problems. If the task was completed in full, it was defined as a success. Introduction of EE into the various subjects raised the students interest to learn. This is due to the process and flexible approach to the learners. Thus, learning management must be flexible for the learners to learn the different topics and solve the problem themselves. The learners would be test without knowing and teachers would test the learners by authentic assessment.

Synthesizing a Model of EE Competency Development for Teacher in Secondary Schools

The EE competency development for secondary school teachers model was an educational innovation that was created by three concepts, which consists of: multidisciplinary instruction learning, community-based learning, project-based learning. The main objective was directed to the development of various teachers to have the ability to manage integrated learning environment for the students. This focused on the conscious mind in the environment, with a feeling of love for the environment before environmental conservation in their appropriate communities and their and wisdom. It consisted of five steps as the **Figure 2**.

Step 1 Analyzing the educational policy was aimed to provide the teachers who teach various subjects to have directed understanding of with national education policy, educational area level, and school.

Steps 2 Studying the community environmental problems were aimed to provide the teachers and students with knowledge and directed understanding of the environmental problems which was currently the facing in the community by the concept of community-based learning.

Step 3 Designing the environmental learning project was aimed to provide the teachers and students to lead the environmental problems in the community to write the projects and let the problems to project based learning.

Step 4 Identifying the Standard of learning. This was aimed to give the teachers and students the confidence that the integrated learning about project-based learning and community - based learning were the learning management with the educational standards within learning areas and educational policy. This was a concern in school, educational area level, and on national level.

Step 5 Performing the integrated lesson plan. The topic was aimed to allow the teachers to apply their knowledge and understanding of integrated interdisciplinary learning to write the integrated lesson plan. There was a mix between the content of the subjects and the EE before the learning to manage the students in the next step.

In conclusion, the process of EE competency development for teachers in secondary school, would give the target audience, who were the teacher that teaches various subjects at the secondary level, to have a systematic EE competency before integrating learning management for students with the concept of

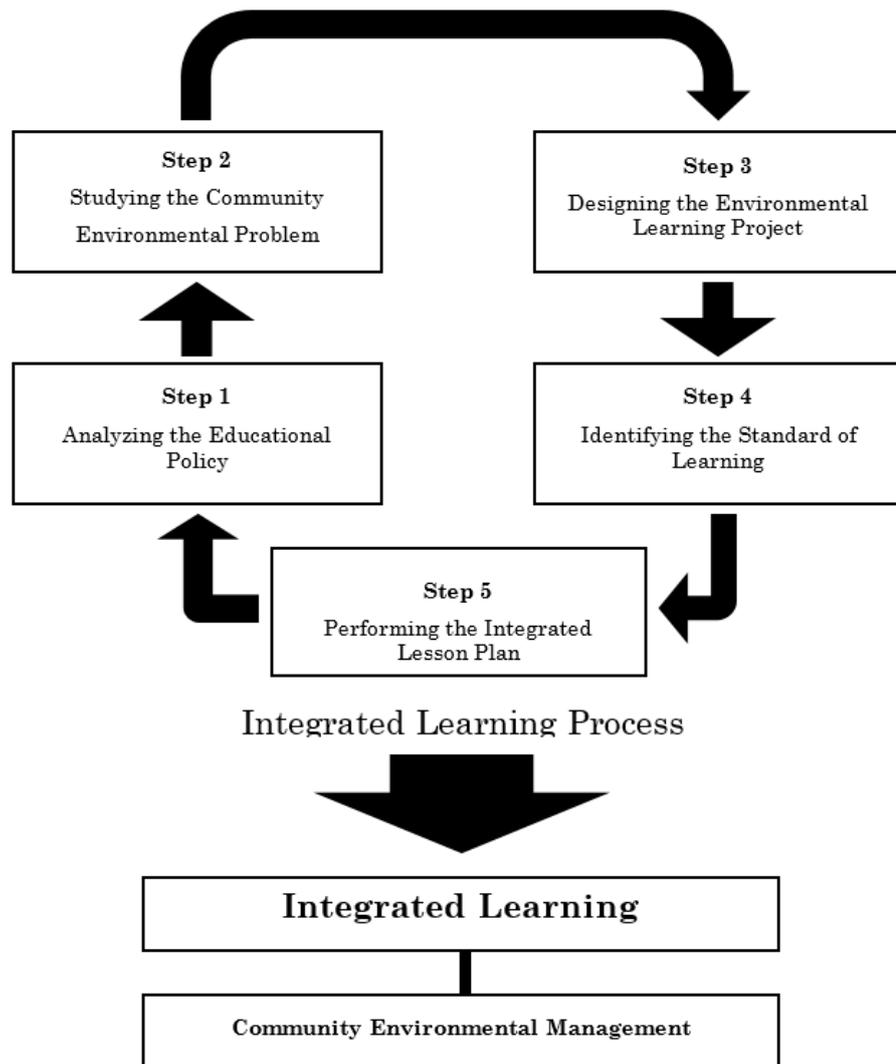


Figure 2. A Model of Environmental Education Competency Development for Teachers in Secondary School

multidisciplinary instruction through project - based learning to lead to management or to solve the environmental problems in the sustainable community continuously.

Innovation quality evaluation, which means the construct validity and content validity of a model by educational experts in EE and three evaluators by using the index of congruence (IOC). This consists of content validity, construct validity, multidisciplinary instruction, community based learning, and project - based learning by educational experts in EE and evaluators.

Content validity consisted of seven items as: analyzing the educational policy, studying the community environmental problems, designing the environmental learning project, identifying the content indicators, performing the integrated lesson plan, integrated learning process, and integrated learning, which reveal IOC was 1.0.

Construct validity consisted of five items as: study the environment in the community before taking the problems as the learning issues, meet teachers in various learning areas for determining the problems issues and learning issues, give the independence to each teacher who teaches in each learning areas to make decision about what they teach and how to teach for according with the natural subject which they respond and to achieve the aims in EE, report the learning management in teachers meeting, and evaluate the integrated learning in teachers meeting, which reveal IOC was 1.0.

Multidisciplinary instruction consisted of five items as: study the environment in the community before taking the problems as the learning issues, meet teachers in various learning areas for determining the

problems issues and learning issues, give the independence to each teacher who teaches in each learning areas to make decision about what they teach and how to teach for according with the natural subject which they respond and to achieve the aims in EE, report the learning management in teachers meeting, and evaluate the integrated learning in teachers meeting, which reveal IOC was 1.0.

Community-based learning consisted of five items as: study the environment in the community before taking the problems as the learning issues, consider the learning management before using for community benefit, realize in the important concept of their beloved hometown, give the importance with local wisdom, and evaluate in Authentic assessment, which reveal IOC was 1.0.

Project-based learning consisted of five items as: write the project before learning management, determine the project of objective clearly, determine the management clearly, have the integration between learning with the practice in the community, and evaluate the cover for personal behavior level and the benefit of the public in the community, which reveal IOC was 1.0.

In addition, the model was evaluated for innovation efficiency. This was done by the examination of the possibility for using real practice of the concept of authentic assessment with 30 secondary school teachers. This consists of internal behaviors, external behaviors, analyzing the educational policy, community-based learning, designing the learning project, identifying the standard of learning, and performing the integrated lesson plan.

Internal behaviors. The researcher has interviewed the participating teachers before training workshop in EE competency development for teachers in secondary schools. This revealed that the teachers lacked the knowledge of EE and refuse to support the students to have environmental awareness, according to believe that only Science teachers could manage the learning activities for the students because the learning content was defined in the Basic Education Core Curriculum 2008. After the teachers have been training workshops, they had the understanding of the objectives of EE and could integrate EE into their students learning activities and respond to the educational policy. In addition, the most teachers had the same opinion to use the community, where it should be a source of learning by starting from community in schools and extending to outside.

During the activities, review of the practice according to the educational policy, the teachers who were assigned in each academic year. They could identify the characteristics and performance of students in "Tree Model" that consisted of roots, trunks, and branches. The components of the tree where the various activities that teachers provide to students in the educational policies of the government, which must be many repeating activities. The researcher had reviewed that teacher's behavior after creating a comparison table of the relationship project. The questions in the table were repeated objectives and the concept of the various activity management could reduce the workload and the time for student's activities. After interviewing the teacher from the presentation of work, they were expected the school administrators to analyze and reduce the repeating activities for students and teachers to be happy with the learning activities.

External behaviors. The teachers could create the base on EE into multidisciplinary instruction, community based learning, and project based learning. This respond to educational policies, and are linked to EE objectives such as: "*The P.Y Clean Project*" that was taught by teachers from eight learning areas its objective and was developed for students to participate in the treatment and rehabilitation of wastewater by adding oxygen according to use kinetic energy from bicycle riding. The teachers could, from this, identify the courses and determine the learning standards.

Analyzing the Educational Policy. Although the development processes of EE for secondary school teachers were limited to participating in the development process of EE by leading the government educational policy that it was the framework to determine in the teachers schedule in schools, such as STEM education, education, elevating English, Twelve values, Buddhism oriented schools, reduce learning time to increase knowledge time, produce good people into society, 21st century learning skills, living skills, academic skills competition, Dharma camp, volunteer spirit in school and outside school, enough learning, and the identity of the school, etc. However, the teachers in competency development have managed various projects by the government, educational policy to analyze the characteristics of each project, including the objectives of the project, student competency, and desirable student of characteristic. The study found that the teachers were able to analyze common feature in each project, then, they create a new project under the common feature, which have been analyzed.

Community based learning. The development process of EE for secondary school teachers that the teachers were limited to participate in the EE development process by a survey around the school. From the survey

they drew a map about walking through and set the area to be used as the issues in accordance with the project. In this process, the researcher had monitored the teachers, who were the participating in the EE competency development process and used questioning techniques to motivate the teachers, which participate in the process of visual and systematic thinking.

When the process was completed, the members of each group were jointly presented the projects that was creating. Knowledge transfer was done by exchanging experience from the relevant topics. The obvious observation that most teachers, who join in the EE development process, did not take care on environmental problems in schools and they never think about these problems, what cause was from, such as the problem of pond smelt in school. After the exchange of learning in the classroom, the researcher found that teachers had begun to criticize the cause of the problem and been focusing how to solve problem.

Designing the learning project, the teachers, who were participating in the development process of EE to jointly created the projects and determined their frameworks. Identifying the standard of learning, the teachers participating in the development process of EE which brought the project designed to identify the indicators to accord with each learning area in the Basic Education Core Curriculum 2008 to plan the learning management according in order to the project management. Thus, each group member needed to write storyline together for using the framework in learning activities to the learners. Performing the integrated lesson plan, the teachers participating in the development process of EE, which design their own lesson plan according to the learning standards.

CONCLUSION

The participation, pilot schools in the Eco-school project have determined their missions in the same direction and focus on student moral development, environmental reservation, a philosophy of economic self-sufficiency, greater environmental awareness for Thai citizens and the world, develops schools inside and outside the classroom, links to homes, temples and schools, and gives these sectors the opportunity to participate in the educational process. The focus is child-centered, using the community resources, and works in accordance with the mission of the Environmental Education School for Sustainable Development Project or Eco-school. These consist of: environmental education and management structure policy, learning management, natural resource and environmental school management, and participation in environmental education networks.

The important barriers in Eco-school mission's management are as follows: teachers and administrators lack of understanding of environmental education, teachers like to teach in the classroom and focus on curriculum contents, teachers have big workloads because of educational policies from the nation, educational areas, and at the school level, teachers lack the skills in environmental education management, and training teachers do not get environmental education skills development from the education policy. The results of the research found interesting points about the EE competency development model for teachers in secondary schools as follows:

Analyzing the educational policy. This was the first step because the teachers needed to ensure that the learning management of integrated EE as a learning management framework of educational policy for various levels, which accorded with Chatzifotiou's (2006, p. 367-381) about the impact of EE to primary teachers in England that focused on the aims to show the interaction between EE, national curriculum, and primary teachers. In addition, it was described in some aspects of education for sustainable development, which had the based on EE as well. Likewise, Ketlhoilwe (2013) studied a government on EE policy with teachers in Botswana, which found that environmental policy studies at the international level had influenced to determine policy in Botswana and teacher's behaviours in environmental teaching. The analysis would seek to understand deeply about "Effect" in the power of EE policy and to be used by teachers in teaching and learning practices. The results of the research found that the educators made many techniques to reaction of various orders by the policy.

Studying the community environmental problem. This topic was the second step accorded with the concept of community-based learning. The research finding of Omsin Jatuporn and Amonrat Wattanaton (2015, p. 83-111), its focus to describe the teaching methods in authentic condition that the teachers can use the local community context as the lab learning for creating the students to be able to think in daily life learning, and also links with the society, culture, and various world places. The study of Place based learning, was a term that originated in a new era of the educational reform around the world by focusing on the resources, people and environment for student's learning about the local community development including knowledge of places,

location based learning, and field studies as well. There were three important concepts for location based learning as the following: the real learning is authentic assessment and it was an interdisciplinary, the concept was about place-based learning will benefit, when was supported by a network and various organizations in communities, and the learning about the community was the important mains, which will lead to understand more deeply to the issues of regional or social world. The research has pointed to teaching about local-based learning, which can stimulate the student's participation enthusiastically, create a curriculum that was meaningful to the students learning in their daily life and make real change to the local community. In addition, D'Amato and Krasny (2011) had conducted a qualitative research for various experiences of the research participants in the Outdoor Adventure Education-(OAE) that the results of study found that the research participants had their experience for their individual change. They believed that the result of spending more time with fresh nature, which had occurred the separating curriculum in daily life from the community/ society that it happened among research participants in the curriculum.

Designing the environmental project. This accorded with the concept of project-based learning, following by the research findings revealed that Supaporn Porntri and Jittima Wattarart (2014, p. 14-26) studied the effects of project based learning management on the change in desirable characteristics that the result of study found as: teachers and students had the same opinion and the students had changed clearly for their behaviors to the harmony in team work, patience, courage, and diligent effort, the most study of project-based learning which got to research the experience outside the classroom by various thinking then they summarize their knowledge themselves, and the learning was through the research base project, which the students were able to develop themselves in all three aspects in order from high to low, such as knowledge, attitudes and process skills. Moreover, the most change in process skills is teamwork skills.

Identifying the Standard of Learning. The teachers needed to determine integrated lesson plan among the learning areas with EE to focus on other subject standard, according to Pimpan Dechakup and Payaow Yindeesuk (2012, p. 9) stated that learning standards were important goal of learner's quality development by identifying about the learners to know, to practice, have the moral, have the ethics, and have the desirable values at the end of their basic education. In addition, it was the drive mechanism all educational system development because the learning standard reflected that what needs to be taught, how to teach, and how to assess. In addition, it will help the curriculum to have the quality and the unity increasingly, according to help the clarifying in the measurement and evaluation of learning and solve the problem of transfer between schools.

Performing the Integrated Lesson Plan, which was integrated in the learning management according to teachers need to design the integrated learning plan. This integrated learning plan will do the learning management to step to the goal or to need effective objectives. According to the concept of Blisshen (1969, p. 27) states that the integrated teaching is opened the opportunity to allow the students and teachers to cooperate for interesting study together that the students may study in small groups or study in individual. The curriculum of integration needs to arrange the appropriate time with the different interests of the students, and in this way inspire for cross-topic of basic knowledge under the guidance of the teacher. In addition, the teachers can find the students, who have the capability and interesting include to the students have the opportunity to develop their skills for owner in the future. According to, Anong Rodsaen, Vareerat Kaew-Urai, and Chantana Chanbanjong (2016, p. 95-105) found that should focus on allowing teachers to design and write the activities plan which cover for encouraging knowledge, understanding in the content, teaching method clearly, and being profound, which encourages the teacher to have a knowledge of the content and pedagogy content knowledge really. In addition to practice, the teacher that use techniques teaching to encourage the students to participate to solving problems for being citizens in democratic system by group discussion and role play. In the collaboration between teachers and students, they ought to determine the goal to the same direction. Thus, the planning was together with the community, so it was the most important cultivate citizenship that if the teachers design and coordinate with the community, which including determining and covering the goals, the plans would be encouraged to learning and collaboration with the community.

However, EE competency of secondary school for teachers should start with pilot teachers in each school which focus on participation from teachers, school personnel, students, and community in problem solving, including using communication base learning and self-assessment to accord with the curriculum that their plans need to systematically and continuously lead to management of results.

Disclosure statement

No potential conflict of interest was reported by the authors.

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