

Environmental Education Learning for Enhancing Wetlands Management in the Northeast of Thailand Using Cooperative-Based Learning

Uraiwai Praimee¹, Prayoon Wongchantra¹, Kannika Sookngam¹, Suparat Ongon¹, Likhit Junkaew¹, Phanadda Ritsumdaeng², Surasak Kaeongam², Thongchai Pronyusri², Kuantean Wongchantra³, Phanat Phothisat⁴, Wutthisak Bunnaen⁵, Pitinuts Sailabat⁶ & Weera Thongnet⁷

¹ Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Maharakham University, Thailand

² Foundation of Environmental Education, Thailand

³ Srimaharakham Nursing College, Faculty of Nursing, Praboromarajhanok Institute, Maha Sarakham, Thailand

⁴ Faculty of Fine-Applied Arts and Cultural Science, Maharakham University Kham Rieng Sub-District, Kantharawichai District, Maha Sarakham 44150, Thailand

⁵ Maharakham University Demonstration School (Secondary) Kham Rieng Sub-District, Kantharawichai District, Maha Sarakham, 44150, Thailand

⁶ Faculty of Liberal Arts and Science, Nakhonphanom University Kham Taow Sub-District, Meang District, Nakhonphanom 48000, Thailand

⁷ Walai Rukhavej Botanical Research Institute, Maharakham University Kham Rieng Sub-District, Kantharawichai District, Maha Sarakham 44150, Thailand

Correspondence: Prayoon Wongchantra, Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Maharakham University, Thailand

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Abstract

The purposes of this research were to develop environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning for being efficient and effective, to study and compare knowledge about wetland management in the Northeast of Thailand, attitudes and environmental ethics before and after learning of undergraduate students and to compare knowledge, attitudes and environmental ethics of undergraduate students with a different gender. The sample used in the research was 107 undergraduate students selected by purposive sampling in the 1st semester of the academic year 2020. The research tools were learning plans on wetland management in the Northeast of Thailand using cooperative-based learning, a knowledge test on wetland management in the Northeast of Thailand, an attitude test, and an environmental ethics test. The statistics used in the research were frequency, percentage, mean, and standard deviation, including hypothesis testing using Paired t-test and F-test (One-Way ANOVA). The results showed that: the efficiency of the learning plans on wetland management in the Northeast of Thailand using cooperative-based learning was 97.78/92.36 and the effectiveness index (E.I.) was 0.9430, indicating that the student's learning progress increased by 94.30%. The undergraduate students had an average score of knowledge about wetland management in the Northeast of Thailand, attitudes and environmental ethics in the post-test was higher than the pretest statistical significance ($p < .05$). There was no difference in the knowledge score of wetland management in the Northeast of Thailand and attitudes of undergraduate students of different gender ($p > .05$). And there was a statistically significant difference in environmental ethics of undergraduate students of different gender ($p < .05$). Male' score of environmental ethics about wetland management in the Northeast of Thailand was higher than females.

Keywords: learning plans, wetland, cooperative-based learning, knowledge, attitudes, environmental ethics

1. Introduction

1.1 Introduce the Problem

Wetlands are characterized by flooded areas, swamp areas, the water is naturally occurring and man-made, both with permanent and temporary floods, both as a source of still water and freshwater, brackish water and saltwater including coastal areas and areas of the sea when the tide is at its lowest. The depth of the water level is not more than 6 meters. Thailand has a wetland area of at least 36,616.16 square kilometers or 22,885,100 rai or 7.5 percent of the area of Thailand. It is divided into 44.8% freshwater area and 55.2% saltwater area. The value of wetlands is as a source of water, rainwater and runoff reservoirs, prevent saltwater from entering the land, prevent coastal erosion, trap sediments and minerals, and prevent various natural disasters. It is a source of natural resources and products that human beings use for benefits such as food sources, medicines, recreation and tourism. It is a collection of biodiversity, plant and animal species that are important in ecology and nature conservation, especially as a source of food chain producers, the importance of history, culture, and way of life, as well as being a natural research center (Office of natural resources and environmental policy and planning, 2021).

The situation in today's world is changing rapidly in various fields. The change in the structure of the population, Thailand must adjust and adjust the direction of the country's development and prepare competent manpower to create higher products to be in line with the changes of the world and enter Thailand 4.0. In this regard, the 20-year national strategy (2018–2037) has set a vision for the development of the country to be stable, prosperous and sustainable in accordance with the sufficiency economy philosophy by focusing on the participation of all sectors. The government gives priority to education reform to accelerate the drive to enhance its ability to compete on par with other countries. The independent committee for education reform (ICER) has formulated a national education reform plan to be in line with the national strategy to raise the quality of education measurements and reduce educational disparities. Defining the issue of reform is reforming the country's overall education and learning system through the new national education act and the secondary law, reforming the development of young children and preschoolers, reforms to reduce educational inequality, reforming mechanisms and production systems for screening and develop professional teachers and teachers, reform of education in response to a change in the 21st century (Secretariat, 2022).

The principle of teaching learners is as important as teaching the students to learn by doing practical things on their own participating fully in education and research to find answers, able to apply the learning method in real life where teachers are supporters of learning. The principles of child-centered learning management can be summarized as follows: 1) Learning is a process that should be lively. Learners should take responsibility for their learning and participate in teaching and learning activities. 2) Learning can occur from different sources. Not only from any one source alone, individual experiences, feelings and thoughts are also important sources of learning. 3) Good learning must be learning that comes from building self-knowledge. Thus, it will help learners to remember and be able to use that learning to their advantage. 4) The learning process is important. If learners have the skills in the learning process, it can be used as a tool for knowledge and answer various needs. 5) Learning is meaningful to learners. It is a learning that can be applied in daily life (Nuangchalerm, 2011). Cooperative learning management is regarded as instructional management that focuses on learners.

Cooperative learning is regarded as instructional management that focuses on learners by using the group process, students have the opportunity to work together for the mutual benefit and success of the group. Cooperative learning is not just for the learners to work in groups such as making reports, doing inventive activities or creating workpieces, discussing and doing experiments. Instructors are not only tasked with summarizing their own knowledge, but also trying to implement strategies that enable students to use the process of processing what comes from the activities. Knowledge Management and summarized as a body of self-knowledge as an important principle (Dachakupl, 2001).

Therefore, environmental education learning enhances wetland management in the Northeast of Thailand by using cooperative-based learning to apply and promote teaching and learning activities in environmental education. There is a total of 7 learning plans, including plan 1 wetlands in the Northeast, plan 2 Bung Khong Long non-hunting area wetland, plan 3 Nong Kut Ting Wetland, Bueng Kan province, plan 4 lower Songkhram river wetland, plan 5 Huai Suea Ten wetland, Khon Kaen province, plan 6 Bueng Gluer wetlands, Roi Et province, plan 7 Nong Han Kumphawapi wetland, Udon Thani province. To provide undergraduate students with knowledge, attitudes and environmental ethics and more participation in teaching and learning activities.

1.2 Research Objectives

1) To develop environmental education learning plans to enhance wetland management in the Northeast by using cooperative-based learning to be efficient and effective.

- 2) To study and compare knowledge about wetland management in the Northeast by using cooperative-based learning, attitudes and environmental ethics of undergraduate students before and after learning.
- 3) To study and compare knowledge about wetland management in the Northeast by using cooperative-based learning, attitudes and environmental ethics of undergraduate students of a different gender.

1.3 Research Hypothesis

- 1) The environmental education learning plans to enhance wetland management in the Northeast by using cooperative-based learning were efficient and effective as 80/80.
- 2) After the learning, the undergraduate students' average score of knowledge about wetland management in the Northeast, attitudes and environmental ethics was higher than before the learning with statistical significance at the level of 05.
- 3) There is a different knowledge score about wetland management in the Northeast, attitudes and environmental ethics among undergraduate students of different gender ($p < .05$).

1.4 Research Conceptual Framework

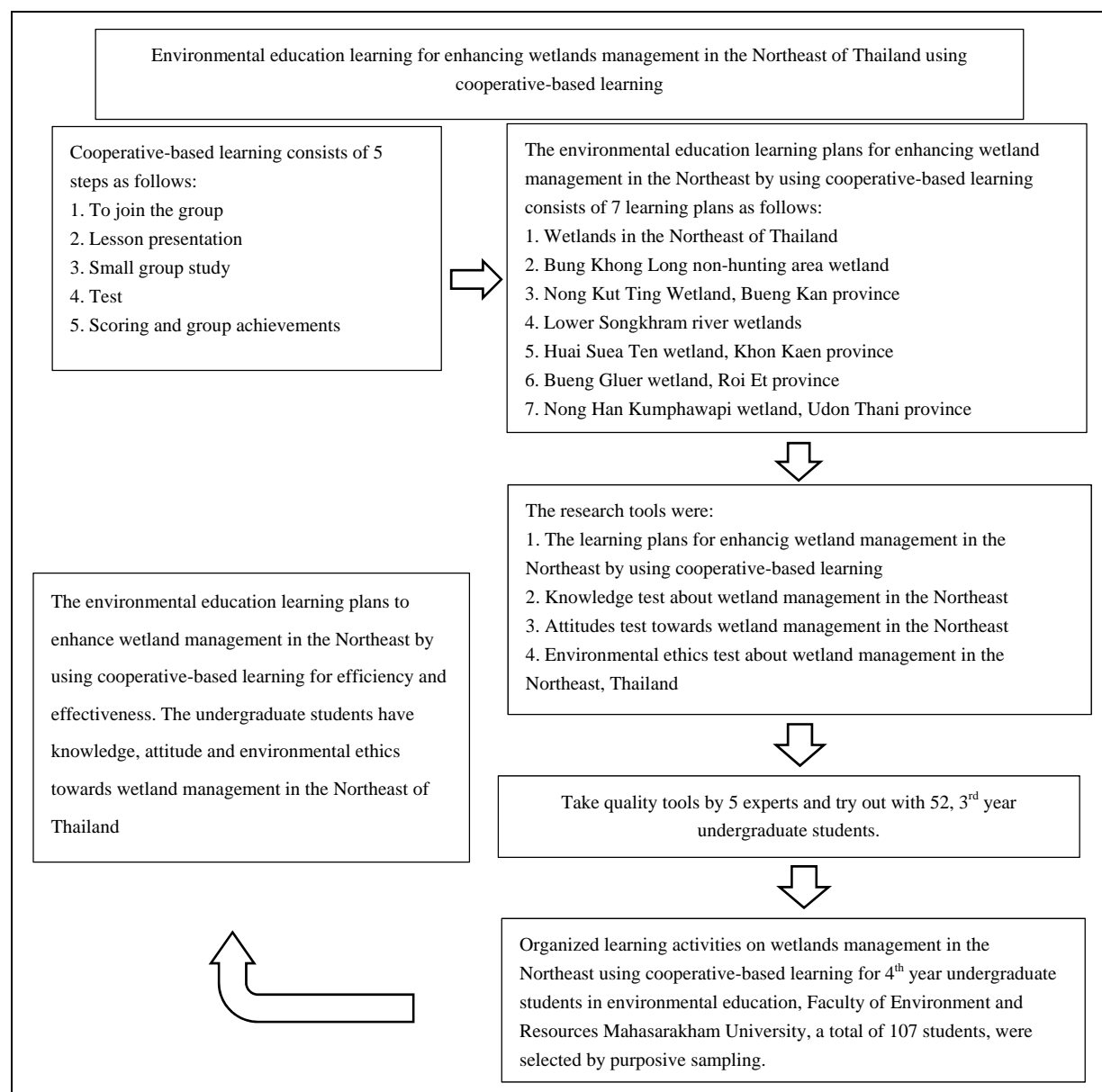


Figure 1. Research conceptual framework

2. Research Design and Method

In the effects of environmental education learning to enhance wetland management in the Northeast of Thailand by using cooperative-based learning, this research was conducted by using one-group pretest-posttest design research by comparing knowledge, attitudes and environmental ethics before the learning, then organized learning activities on wetland management in the Northeast of Thailand by using cooperative-based learning and take tests after learning. The symbolic view of this design is given in Table 1 (Srisaat, 2000).

Table 1. One-group pretest-posttest design research plan

Sample Group	Pre-test	Treatment	Post-test
E	O ₁	X	O ₂

Note. E: Experimental group; O₁: Pretest; X: Treatment (learning activities on wetland management in the Northeast of Thailand by using cooperative-based learning); O₂: Posttest.

2.1 Population and Sample

1) The population used in this research was 329 undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Maharakham University in the 1st semester of the academic year 2020.

2) The Sample used in the research were 107 undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Maharakham University in the 1st semester of the academic year 2020, which were derived by purposive sampling.

2.2 Studied Variables

The independent variables were environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning and the gender of sample students.

The dependent variables were knowledge about wetland management in the Northeast of Thailand, attitudes and environmental ethics.

2.3 The Research Tools

1) Environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning.

2) Knowledge test about wetland management in the Northeast of Thailand.

3) Attitude test towards wetland management in the Northeast of Thailand.

4) Environmental Ethics test about wetland management in the Northeast, Thailand.

2.4 The Checking Tools' Quality

1) Study principles and methods for creating an environmental education learning plan to enhance wetland management in the Northeast of Thailand by using cooperative-based learning by studying the concepts, theories, documents and related research to determine the content in accordance with the curriculum and course descriptions.

2) Define scope and content structure and create research tools, including:

① The environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning as a learning base consisting of 7 learning plans.

② Knowledge test about wetland management in the Northeast. It is multiple choice with 4 options, A, B, C and D to choose only one correct answer. The criteria for a correct answer gave 1 point, a wrong answer gave 0 points, and 35 items total 35 points. The criteria for interpreting the points are as follows on Srisaat (2000). It showed that the average score was 0.00–7.00 means that the students have the least level of knowledge, the average score was 7.01–14.00 means that the students have a low level of knowledge, and the average score was 14.01–21.00 means that students have moderate knowledge, the average score was 21.01–28.00 means that the student's knowledge was at a high level and the average score was 28.01–35.00 means that students have the knowledge at the highest level.

③ Attitude test towards wetland management in the Northeast. There were 5 levels as follows: the average

score was 1.00–1.80 for strongly disagree, the average score was 1.81–2.61 for disagree, the average score was 2.62–3.41 for neutral, the average score was 3.42–4.21 for agree and the average score was 4.22–5.00 for strongly agree, total 35 items (Srisaat, 2000).

④ Environmental Ethics test about wetland management in the Northeast. There are 35 items of 4 options which are A, B, C and D. There are 4 levels set by the ethical rating as follows on Wongchantra (2016). Level 1: average score 1.00–1.75 for myself, Level 2: average score 1.76–2.50 for the relatives and friends, Level 3: average score 2.51–3.25 for society and Level 4: average score 3.26–4.00 for the rightness and goodness.

3) Bring the created tools sent to 5 experts to consider the consistency of the research tools to the objective. It found that the knowledge test about wetland management in the Northeast had an IOC value of 0.78. The attitude test towards wetland management in the Northeast had an IOC value of 1.00. The Environmental Ethics test about wetland management in the Northeast had an IOC value of 1.00. Showed that all questions can be used for data collection.

4) Take the knowledge test about wetland management in the Northeast, Thailand, attitude test and environmental ethics test to try out with the 3rd year, 52 undergraduate students of Department of Environmental Education, Faculty of Environment and Resource Studies, Maharakham University, that is not a sample to find the difficulty, the individual value of authority and the confidence of the whole version found that:

① The knowledge test about wetland management in the Northeast had an appropriate level of difficulty: the lowest 0.51 and the highest 0.75 for the individual discrimination using criteria for classifying high and low groups analysis of the discriminant power for each item with a value of 0.20 and above. It was found that all questions were individual discretionary powers at the valid level between 0.32–0.60, and the whole confidence of the Cronbach's alpha coefficient method of knowledge test set to be value greater than 0.70 is considered a test with confidence and can be used in research. The results were found to be a confidence factor of 0.74, indicating that all of the knowledge tests were compliant with the higher tolerances greater than 0.70 and could be used for data collection.

② Attitude test towards wetland management in the Northeast has been found that all questions had the authority to classify each item in the applicable level between 0.31–0.99 while the whole confidence value was found to be 0.89, indicating that all attitude tests had higher confidence than the criterion and could be used for data collection.

③ Environmental ethics test about wetland management in the Northeast has been found that all questions had the authority to classify each item in the applicable level between 0.25–0.65 while the whole confidence value was found to be 0.90, indicating that all environmental ethics test had higher confidence than the criterion and could be used for data collection.

5) Take the research tools to improve as complete and then used them to collect the data with the sample.

3. Data Collection

1) Prepare teaching materials, including the environmental education learning plans to enhance wetland management in the Northeast of Thailand, a knowledge test about wetland management in the Northeast, an aptitude test and an environmental ethic test.

2) Take a pre-test with a sample of students by using a knowledge test about wetland management in the Northeast, an attitude test and an environmental ethic test.

3) Teach using an environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning with the 107 undergraduate students in the Environmental Education program, Faculty of Environment and Resource Studies, Maharakham University in the 1st semester of the academic year 2020, which were derived by purposive sampling in the environmental education training course, the steps are as follows:

Step 1 Steps to join the group: Begin by dividing the students into groups of 5–6 students each. The instructor explains introductory so that learners know how to teach, the roles of learners and research resources.

Step 2 Steps to present a lesson: Conduct teaching activities or lecture content according to the environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning, this consists of a total of 7 learning plans.

Step 3 Step to small group study: The researcher assigns tasks according to the content of the learning plans, to define the scope of work and define the roles and responsibilities of each person in the group. The members of the group share the responsibility for the assigned tasks.

Step 4 Step to sub-test: During the learning activities, the students had to test their knowledge during the learning process.

Step 5 Scoring process and group achievements: The researcher and students together summarize their knowledge about wetland management in the Northeast of Thailand. To achieve the set learning goals and make an assessment.

4) When teaching all 7 learning plans, take a post-test with a knowledge test about wetland management in the Northeast, an environmental attitude test and an environmental ethic test which are the same set as the pre-test. The learning activities are presented as shown in Table 2.

Table 2. Environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning

Week	Learning activities plans	Period (hour)
1	Introduce the learning activity plan, pretest for knowledge, attitude and environmental ethics	3
2-3	Activity plan 1: Wetlands in the Northeast	6
4	Activity plan 2: Bung Khong Long non-hunting area wetland	3
5	Activity plan 3: Nong Kut Ting Wetland, Bueng Kan province	3
6	Activity plan 4: Lower Songkhram River wetlands	3
7	Activity plan 5: Huai Suea Ten wetland, Khon Kaen province	3
8	Activity plan 6: Bueng Gluer wetlands, Roi Et province	3
9	Activity plan 7: Nong Han Kumphawapi wetlands, Udon Thani province	3
10	Study tour of the Nong Bua wetland, Maha Sarakham province	3
11	Summary of learning activity plan on wetland management in the Northeast of Thailand by using cooperative learning	3
12	Posttest for knowledge, attitude and environmental ethics	3
Total		36

4. Statistics Used in Data Analysis

1) The basic statistics are mean, percentage, frequency and standard deviation.

2) The statistics to test the efficiency of the tools were the suitability of the learning activity plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning, conformity index value, and the difficulty of the test of knowledge about wetland management in the Northeast. The discriminant power of the questionnaire, confidence value, process efficiency value (E_1), result efficiency value (E_2) and effectiveness index (E.I.).

3) Statistics test results and hypotheses at the .05 level of statistical significance, namely Paired t-test and One-Way ANOVA.

5. Results

1) The effect of environmental education learning for enhancing wetlands management in the Northeast of Thailand using cooperative-based learning, it was found that:

Results of a study on the efficiency and effectiveness of the environmental education learning plan to enhance wetland management in the Northeast of Thailand by using cooperative-based learning, it was found that the efficiency of the process (E_1) was 97.78% and the efficiency of the result (E_2) was 92.36%. Therefore, the efficiency of the environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning was 97.78/92.36, which met the 80/80 criterion as a set. The effectiveness index of the environmental education learning plan to enhance wetland management in the Northeast of Thailand by using cooperative-based learning was 0.9430, indicating that the student's learning progress increased by 94.30%.

2) The effect of the study and comparison of the knowledge average score on wetland management in the Northeast, Thailand, attitude and environmental ethics of students before and after the learning on wetlands management in the Northeast using cooperative-based learning, it was found that: (as shown in Table 3).

① The undergraduate students had an average score of the knowledge of wetland management in the Northeast of Thailand using cooperative-based learning, before the learning (pretest) was overall at a high level ($\bar{x} = 21.27$) and after the learning (posttest) was overall at the highest level ($\bar{x} = 32.38$). When comparing the knowledge average score of wetland management in the Northeast using cooperative-based learning before and after the learning

(pretest-posttest), it was found that after learning, the undergraduate students had knowledge scores higher than before the learning statistical significance ($p < .05$).

② The undergraduate students had an average score of attitudes towards wetland management in the Northeast of Thailand of the pretest overall learning at disagree level ($\bar{x} = 2.25$) and the posttest was overall at the agreed level ($\bar{x} = 3.94$). When comparing the attitude average scores pretest and post-test, it was found that the undergraduate students had an average score on attitude in the post-test higher than the pretest statistical significance ($p < .05$).

③ The undergraduate students had an average score of environmental ethics of the pretest overall learning at the for relatives and friends level ($\bar{x} = 2.33$) and the post-test was overall at the for society level ($\bar{x} = 3.23$). When comparing the environmental ethics average score pretest and post-test, it was found that the undergraduate students had an average score on environmental ethics in the post-test higher than the pretest statistical significance ($p < .05$).

Table 3. The effect of the comparison of the knowledge average score on wetland management in the Northeast of Thailand, attitude and environmental ethics of students before and after the learning using Paired t-test (n = 107).

Item	Pretest		Level	Posttest		Level	t	df	p
	\bar{x}	S.D.		\bar{x}	S.D.				
Knowledge (N=35)	21.27	0.14	high	32.28	0.12	highest	-21.224	106	.000*
Attitude (N = 5)	2.25	0.44	disagree	3.94	0.39	agree	-30.154	106	.000*
Environmental ethics (N = 4)	2.33	0.22	For relatives and friends	3.23	0.24	For society	-33.405	106	.000*

Note. *Statistically significant .05, N: full score.

3) The effect of the study and comparison of the knowledge average score on wetland management in the Northeast, attitude and environmental ethics of the undergraduate students with different gender, it was found that: (as shown in Table 4)

There were no differences in undergraduate students' average score of knowledge about wetland management in the Northeast and the attitude of undergraduate students of a different gender. There was a statistically significant difference of scores in environmental ethics of undergraduate students with different gender levels ($p < .05$). Which male have environmental ethics higher than female.

Table 4. Comparative results of knowledge about wetland management in the Northeast of Thailand, attitude and environmental ethics of the undergraduate students with different gender using One-Way ANOVA

List	Gender	Number	One-Way ANOVA			
			\bar{x}	S.D.	F	Sig.
Knowledge	male female	35	32.08	1.52	1.16	0.282
		72	32.44	1.65		
Attitudes	male female	35	3.88	0.37	0.569	0.452
		72	3.94	0.40		
Environmental ethics	male female	35	3.30	0.19	4.16	0.044*
		72	3.20	0.26		

Note. *Statistically significant .05, N: full score.

6. Discussion and Conclusion

The effect of environmental education learning for enhancing wetlands management in the northeast of Thailand using cooperative-based learning be summarized and discussed as follows:

1) Learning outcomes of environmental education learning plans for enhancing wetlands management in the northeast of Thailand using cooperative-based learning.

Environmental education learning plans for enhancing wetlands management in the northeast of Thailand using cooperative-based learning, it was found that the efficiency and effectiveness of the environmental education learning plan to enhance wetland management in the Northeast, Thailand by using cooperative-based learning, that the efficiency of the process (E_1) was 97.78% and the efficiency of the result (E_2) was 92.36%. Therefore, the environmental education learning plans to enhance wetland management in the Northeast of Thailand by

using cooperative-based learning efficiency was 97.78/92.36, which met the 80/80 criterion asset. The effectiveness index of the environmental education learning plans to enhance wetland management in the Northeast of Thailand by using cooperative-based learning was 0.9430, indicating that the student's learning progress increased by 94.30%. This is a result of the researcher has studied the theory and principles of creating learning plans. The researcher has defined the content of 7 learning plans to be consistent with the purpose and suitability of the students. Then, the learning plan is qualitatively tested by experts and tested to determine its feasibility of the learning plan, thus making it effective and applicable in actual teaching. In addition, the researcher has applied 5 steps of teaching by using cooperative-based learning as follows: 1) To join the group 2) Lesson presentation 3) Small group study 4) Test 5) Scoring and group achievements so that all students can exchange their opinions. This is to encourage students to think and analyze various issues using the principles of environmental education to participate. This makes students gain knowledge and understanding, and have awareness and ethics which will lead to participation in the conservation of the environment of various wetlands. And cooperative learning principles and techniques can help teachers encourage such enhanced cooperation among students. which is based on the concept of George Jacobs et al. (2008, pp. 103–107) cooperative learning, also known as collaborative learning, is a body of concepts and techniques for helping to maximize the benefits of cooperation among students. A wide range of theoretical perspectives on learning—including behaviorism, socio-cultural theory, humanist psychology, cognitive psychology, social psychology and Piagetian developmental psychology—have been used to develop and justify different approaches to cooperative learning. Similarly, various principles have been put forward in the cooperative learning literature. Rangabtuk (1999) has mentioned that collaborative learning is a method of teaching activities that emphasizes on organizing a learning environment for learners to learn together as a small group where each person participates in learning, and exchanges ideas to succeed in learning. And also explained the learning management plan is to bring the subjects or group of experiences that must be made into a learning plan throughout the semester to create a learning activity. The use of media, learning tools and evaluation and evaluation by organizing the content and the objectives of the sub-learning in accordance with the objectives. The efficacy of the learning plan using the E_1/E_2 criterion is a method that can measure the overall effectiveness of the learning plan in a broad manner (Brahmawong, 1996). Efficiency is the average percentage score obtained from the process during the learning of the entire group of learners. It will be close to the average percentage score obtained from the test after learning, should not differ by more than 5% (Kungkatum & Suriyachaiwattana, 2015). And finding the effectiveness of learning plans or created media based on student development before and after learning whether there is a reliable increase in knowledge and abilities or how much increased. It may be determined by calculating the t-test using dependent samples or looking for the index of effectiveness. (Effectiveness Index: E.I.) (Jitrakarn, 2003). The Effectiveness Index is a value that indicates learning progresses based on existing prior knowledge. After the learners have learned from the media, innovation or learning plan (Srisaat, 2002). This is consistent with the study results of Cumrae et al. (2016) developed an environmentally friendly consumer training manual for undergraduatstudentsat at Mahasarakham University, it was found that the efficiency of the manual was 80.70/83.68, while the efficiency index of the training manual was 0.7900. And Chotikapanit (2006) found that the environmental education learning plan according to the 7-step learning cycle model using multiple intelligences was 84.69/90.19 and the effectiveness index was 81.00%. And Khotchompoo et al. (2018) found that the community forest management training manual was effective at 86.80/98.48. The effectiveness index of the manual was 0.9127, which was in line with the applicable standard. And Promta and Wongsa (2018) found that the efficiency of teaching management in the inverted classroom with lessons on social networks was 84.75/89.07 and the effectiveness was 0.72. Therefore, it showed that the environmental education learning for enhancing wetlands management in the northeast of Thailand using cooperative-based learning is efficient and effective. It is a learning plan that can be used to manage to teach and learn for students in environmental education, Faculty of Environment and Resources, Mahasarakham University to develop knowledge and further analytical thinking skills.

2) The effect of the study and comparison of the knowledge average score on wetland management in the Northeast of Thailand, attitude and environmental ethics of students before and after the learning on wetlands management in the Northeast using cooperative-based learning.

① The undergraduate students had an average score of knowledge on wetland management in the Northeast using cooperative-based learning, it was found that after learning, the undergraduate students had knowledge scores higher than before the learning statistical significance. This may be a consequence of the researchers developing cooperative-based learning which is a learning that has a group learning style. Group members participate in the exchange of ideas, work together and are responsible for their own work. So, students can express their thoughts, analyze responsibilities and help each other within the group. In Dechakhup (2001) discussed cooperative-based

learning as a base for teaching and learning that uses group processes to allow learners to have the opportunity to work together, for the benefit and success together. As Soonthornrot (2006) said that cooperative-based learning is a learning management method that focuses on providing a learning environment for learners to learn together in small groups. Each group consists of group members with different abilities. Each person has a real contribution to learning and to the success of the group. Thapthieng (2007) said that Cooperative learning is a process in which students with different abilities coexist and work together to achieve the same goal. This is consistent with the findings of Promta and Wongsa (2018) found that the effects of the instructional management using the flipped classroom model together with lessons on social networks in the 'Self-Actualization for Teachers' course. After Students have academic achievement higher than before the study. And Junkaew, Wongchantra and Bunnaen (2021) found that Undergraduate students have knowledge about Khok Hin Lad Community Forest. (Huai Ka Kang Watershed Forest) after learning was higher than before learning. And Tee-ngam, Wongchantra and Sachiyo (2016) developed environmental conservation youth camp activities by using the environmental education process, found that the youth had higher average scores of knowledge about environmental conservation after the activities than before the activities with statistically significant at the level of .05. As Boonserm, Wongchantra and Sali (2016) found that after activities, the students had average scores of knowledge about environmental conservation by using the green poem process higher than before the activities. And consistent with the findings of Chaloeisuk, Limmanee and Sookngam (2018) found that the undergraduate students had an average knowledge after promotion higher than before promotion with statistically significant. Therefore, it was demonstrated that the learning plans on wetland management in the Northeast of Thailand using cooperative-based learning were effective and appropriate in developing knowledge about wetland management for undergraduate students.

② The undergraduate students had an attitude about wetland management in the Northeast of Thailand using cooperative-based learning in the posttest higher than the pretest. This is because attitudes are feelings, thoughts, beliefs and tendency to express behavior. Through the 7 learning plans, there are activities to promote and insert activities in order for students to develop a positive attitude towards the environment. In Wongsawasdiwat (1995) said that attitude is the knowledge, understanding and feelings a person has about something. It is the result of an experience or environment that tends to cause a person to react and act on something in a supportive or negative way. Sukontaviroj (2017) has said that attitude is something that cannot be seen clearly knowing the attitude of a person requires a method of interpreting the expression in which a person's behavior is a reaction by estimating likes or dislikes. It also determines the actions or behaviors of that person that will either positively or negatively affect other people, things, and situations. Attitudes can lead to actions towards one or another person, in a consistent or inconsistent. This depends on the many variables that occur in the situation (Jirarungsangsatit, 2013). This is consistent with the findings of Natphong, Boonserm and Praimee (2021) found that the undergraduate students had an attitude toward the application of geographic information systems in the initial environmental evaluation after learning was higher than before with statistically significant at the level of .05. And Pronyusri, Boonserm and Junkaew (2021) found that the undergraduate students who study environmental education using problem and focus group-based learning had attitude after learning higher than before learning. And Kurukodt et al. (2018) found that the undergraduate students who attended the waste management training had attitudes toward waste management after the training higher than before the training. And Wongarmat et al. (2018) found that the villagers had an attitude towards household wastewater management after the promotion was higher than before the promotion. Therefore, it showed that learning activities on wetland management in the Northeast using cooperative-based learning, resulted in students having a more positive attitude towards the environment.

③ The undergraduate students had environmental ethics about wetland management in the Northeast of Thailand using cooperative-based learning in the posttest higher than the pretest. However, teaching by using cooperation as a learning base in addition to having group divisions for students to think and analyze together. There are also activities in which the researcher inserts a hypothetical situation and role for students to express their knowledge, thoughts, and behaviors on the environment. Wongchantra (2012) indicated that environmental ethics refers to the principle that one should conduct one's behavior towards the environment which results in the existence of the environment in ecological equilibrium and for the benefit of all things that rely on the environment to survive without losing the relationship between people and the environment. As Weerawattanon (1993) said that environmental ethics is a principle of human conduct that adheres to goodness and integrity, correctness according to moral principles and kindness that should be treated to the environment. Environmental ethics is a behavioral quality that society expects people in that society to behave properly. There is freedom in the sphere of conscience. It is a duty that members of society can act in such a way that the practitioner must know what is right and what is wrong (Sorasuchat, 2013). This is consistent with the findings of Wongchantra (2008) has studied the development of the environmental education teaching process by using ethics infusion for undergraduate students, the results of

the study found that the students had average scores on environmental ethics after learning higher than before learning. And Udornpim and Wongchantra (2021) found that the students who participated in the training of environmental protection volunteers in the school. There are the students who have environmental ethics higher than before training. And Chanwirat, Wongchantra and Bunnaen (2021) found that the students who studied environmental education activities for the developing environment and occupational health in school had environmental ethics after using the learning activities set higher than before activities. And Ritsumdaeng, Boonserm and Sookngam (2021) found that the students had average scores on environmental ethics after teaching with conservation of water resources by doing watershed divisions according to the King's science higher than before teaching. And Nakmuenwai, Wongchantra and Junkaew (2018) found that the students participating in the training on the ecosystem of the deciduous dipterocarp forest have an average score on environmental ethics after training higher than before training.

3) The effect of the study and comparison of the knowledge average score on wetland management in the Northeast of Thailand, attitude and environmental ethics of undergraduate students with different gender, found that:

The undergraduate students of different gender were no different of knowledge about wetland management in the Northeast of Thailand and attitude. And there was a statistically significant difference in environmental ethics of undergraduate students of different gender ($p < .05$). Males have environmental ethics about wetland management in the Northeast of Thailand higher than females. This may be because all students, whether male or female, have participated in the wetland management in the Northeast as well, as a result, the students had no difference in knowledge and attitudes towards wetland management in the Northeast. And male students have a clear expression and have more leadership than females, resulting in males having higher environmental behaviors than females. In Sophakan (2007) said that knowledge is the perception of facts, and detailed events resulting from observations, education, and experience in both the natural environment and basic knowledge society. Or the background of the individual that the person has memorized or collected and can manifest behaviorally. And Jirungsangsathit (2013) said that attitudes are thoughts or feelings towards a particular thing or person. This can lead to action on something in a consistent or inconsistent way. It depends on many variables that occur in a particular situation. And Wongchantra (2012) said environmental ethics refers to a principle that should behave towards the environment which results in the existence of the environment in ecological equilibrium. and for the benefit of all things that depend on the environment to survive without losing the relationship between people and the environment. This is consistent with the findings of Praimee and Boonserm (2021) found that the undergraduate students of different gender were no different knowledge about waste and sewage management. And Thinkhamchoet, Wongchantra and Bunnaen (2021) found that the undergraduate students of different gender were no different of knowledge about environmental conservation. And Polyiam et al. (2013) found that the students of different gender were no different in critical thinking related to the use of science. And Ritsumdaeng, Boonserm and Sookngam (2021) found that the undergraduate students of different gender were no different of knowledge about environmental and attitude. And Muhittin Şahin, Tarik KIŞLA. (2016) have studied attitudes towards personal learning environments of undergraduate students. It was found that gender variables had no effect on attitudes towards personal learning environments. As Banyaikit, Saktawee and Sutthiyam (2019) found that the students with different gender were no differences in overall and individual attitudes towards educational management. And Wongchantra et al. (2008) found that undergraduate students with different gender had a difference in environmental ethics. And Kaewwilai (2008) found that undergraduate students of different gender had different perceived ethical behaviors.

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