

The Effect of Environmental Education Teaching Using Case Study and Games based Learning for Undergraduate Students

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ABSTRACT

The purposes of this research were to develop environmental education teaching plans using case study and games based learning to be efficiency and effectiveness, to study and compare environmental knowledge, environmental attitude and environmental ethics before and after teaching and to compare environmental knowledge, environmental attitude and environmental ethics of students with different gender. The sample used in the study were 81 the 2nd Year undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Mahasarakham University. The research tools were the environmental education teaching plans using case study and games based learning, environmental knowledge test, environmental attitude test and environmental ethics test. The statistics used for data analysis were frequency, percentage, mean, standard deviation and hypothesis testing using t-test and F-test (One-Way MANOVA, One-Way MANCOVA). The results of the research showed that: 1) The environmental education teaching plans using case study and games based learning for undergraduate students were efficiency of 88.67/84.22, effectiveness of the activity index was equal to 0.7146. The students had more environmental knowledge and effected to increased students progress after learning at 71.46 percent. 2) After the teaching, the students had average score of environmental knowledge, environmental attitude and environmental ethics higher than before the teaching statistically significance level 0.05. 3) There was no difference of average score of environmental knowledge, environmental attitude and environmental ethics of the students with different gender.

Keywords

Environmental education teaching; Case study and games based learning; Environmental knowledge; Environmental attitude; Environmental ethics

Introduction

The humans are facing environmental problems today, whether there are global warming problem, solid waste problem, flood problem, drought problem, waste water problem, pollution problem, soil deterioration problem, deteriorating problem, natural disaster problems, as well as economic, social and cultural problems, which are considered environmental problems that are becoming more and more severe every moment until these affect environment quality and life quality of people in society and these are accepted that environmental problems arise from human life activities [1]. Therefore, solving the problem to be successful have to start first with the human being. And it is imperative that everyone, both public and private, globally, regionally, nationally and locally should be involved in preventing and solving environmental problems that arise. As a result, many countries are constantly vigilant about environmental problems. This can be seen from the study of Kansabai to find ways to prevent, develop, restore and conserve the environment. This will be a solution to environmental problems that are effective and sustainable. And one of the solutions to environmental problems that is considered the most effective and leads to sustainable solutions to environmental problems providing education both in the non-formal education system on the environment and environmental problems that affect the quality of the environment and on the quality of life [2].

Environmental education is the process of transferring environmental knowledge in order to give human knowledge about the environment, attitudes and values that is good for the environment, environment awareness of environmental problems, skills in solving environmental problems, participation in solving environmental problems and evaluating environmental problems to cause environmental quality and quality of life [3], which the broadcaster must enhance the learning atmosphere, it helps learners gain interest from the start to bridge the gap between the broadcaster and the broadcast receiver, making it easy to engage. This will make difficult things become easy stress, relief makes students interest and impressive follow-up a professional broadcaster have to a technique to convey [4].

Case Based Learning (CBL) is a process that teachers use to help learners achieve their intended learning objectives by having students study a fictional story from reality and answer questions about it. Then use the answer and the reason for its origin to enable the learners to learn objective [5]. The steps were a model of teaching environmental education by using a case study learning method prepare a learning plan with steps to create a learning management plan by studying textbook documents,

course structure and details of course content, environmental ethics and studying textbooks on how to write a learning management plan through a case study to write a lesson plan, it consists of 5 steps were 1) teaching preparation, 2) case study preparation, 3) analysis stage, 4) conclusion, 5) evaluation stage. This will help encourage learners to self-assess in organizing learning activities for case studies [6].

Game Based Learning (GBL) is a process that teachers use to help learners achieve specific learning objectives by allowing learners to play games according to the rules and bring the content and information of the game learning playing behavior. Playing methods and game results were used in discussion to summarize learning [7]. This is a process that teachers use to help learners achieve the specific objectives by having the students play the game according to the rules and using the content of the game, playing behavior, playing methods and the students game results in discussion to summarize learning. It's a way to help students learn things in a fun and challenging way. The students are the players themselves making it gain hands-on experience, it is a method that allows students to participate highly [5].

Therefore, the researcher has adopted a new process method to be used in teaching and learning to develop effective learning. This will help to make education and teaching more effective, that students can learn faster and more efficiently get motivated to learn. The researcher has applied the teaching method by using the case study model and the game for the teaching and learning management for the students in Environmental Education program. It is another form of teaching that learners can apply, so that the learners can learn in various ways and change from the original, not repetitive students are encouraged to be more thoughtful and assertive in different ways.

Research objectives

- 1) To develop environmental education teaching plans using Case Study and Games Based Learning to be efficiency and effectiveness.
- 2) To study and compare environmental knowledge, environmental attitude and environmental ethics before and after learning.
- 3) To compare environmental knowledge, environmental attitude and environmental ethics of students with different gender.

Methodology

1. The Population and Sample

The population used in this research were 333 undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Mahasarakham University.

The sample used in the research were 81 the 2nd undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Mahasarakham University, which were derived from purposive sampling, 32 male and 49 female students.

2. The Research Design

1) Design and development of environmental education teaching using Case Study and Games Based Learning for undergraduate students. It was quasi experimental research by using one sample group as an experimental group. The results were measured before and after the experiment (One Group Pretest-Posttest Design).

3. The Research instruments

The researcher has built and evaluated the quality of the research tools, the procedure as follows:

3.1) The environmental education teaching plans using Case Study and Games Based Learning for undergraduate students.

1) Study and research preliminary information related to the development of teaching plans using Case Study and Games Based Learning for undergraduate students, documents and related research to determine the content in accordance with course descriptions.

2) The researchers had developed 8 teaching plans using Case Study and Games Based Learning for undergraduate students; plan 1: waste management, plan 2: soil management, plan 3: water management, plan 4: wildfire management, plan 5: forest conservation, plan 6: waste water management, plan 7: global warming and plan 8: sufficiency economy philosophy which researchers had applied from theory of Sukon Sinthapanon [6] and

TissanaKhammanee [5]. There were 6 steps; step 1: teaching preparation, step 2: game play, step 3: case study preparation, step 4: analysis stage, step 5: conclusion, and step 6: evaluation.

3) Bring these teaching plans to check for assessment from 5 experts.

4) Adopt these teaching plans from expert assessment. These teaching plans were found that teaching plans were the suitability at the mean ($\bar{x}$) = 4.58 and the standard deviation (S.D) was at 0.19 in the most appropriate level and the consistency value (IOC) was at 0.96.

5) Improve these teaching plans according to the evaluation and recommendation of the experts. Then try out with 1st undergraduate students being divided into 3 groups: small group, middle group and large group.

6) Adopt these teaching to improve and complete for collection with the sample.

3.2) Environmental knowledge test.

1) Study basic information from textbooks, research articles to create it.

2) Use data to create it which there are 40 items having 4 options; A, B, C and D, only one correct answer. It showed that the criteria for interpreting the points are as follows: the average score is at the least level of knowledge (0.00 – 7.99), the average score is a low level of knowledge (8.00 – 15.99), the average score is at moderate level of knowledge (16.00 – 23.99), the average score is at a high level of knowledge (24.00 – 31.99) and the average score is at the highest level of knowledge (32.00 – 40.00) [8].

3) Take it to 5 experts for considering. It showed that the index of item objective congruence was at 0.98, which can be used for data collection.

4) Take it to try out with 75 undergraduate students that were not the sample to analyse the difficulty index, discrimination and reliability. It was found that there was an available difficulty index level; the lowest 0.65 and the highest 0.96 using criteria for classifying high and low groups analysis of the discrimination to classify each item with a value of 0.20. There was at a valid level; 0.23 – 0.86. was found that there was the reliability of the knowledge test using the α - Cronbach Coefficient method at 0.946, indicated that all tests of knowledge comply with an acceptable value of 0.70, which can be used to collect the data with the sample.

3.3) Environmental attitude test.

1) Study basic information from textbooks, research article to create it.

2) Use data to create it, which there are 40 items, 4 options being rating scale. There were 5 levels as follows: the average score is for strongly disagree (1.00 – 1.80), the average score is for disagree (1.81 – 2.61), the average score is for neutral (2.62 – 3.41), the average score is for agree (3.42 – 4.21) and the average score is for strongly agree (4.22 – 5.00).

3) Take it to 5 experts for considering. It showed that the index of item objective congruence was 0.97 which can be used for data collection.

4) Take it to try out with 75 undergraduate students that were not sample to analyse the difficulty index, discrimination and reliability. It was found that there was available discrimination at a valid level; 0.23 – 0.81. There was the reliability using the α - Cronbach Coefficient method at 0.958, indicated that all tests of environmental attitude comply with an acceptable value of 0.70 which can be used to collect the data with the sample.

3.4) Environmental ethics test.

1) Study basic information from textbooks, research article to create it.

2) Use data to create it. There were 4 options, 40 items, which were: A, B, C and D. There are 4 levels of the ethical rating as follows: the average score is for myself (1.00 – 1.75) the average score is for relatives and friends (1.76 – 2.50), the average score is for society (2.51 – 3.25) and the average score is for correctness and goodness (3.26 – 4.00).

3) Take it to 5 experts for considering. It showed that there was the index of item objective congruence at 0.94 which and can be used for data collection.

4) Take it to try out with 75 undergraduate students that were not a sample to analyse the difficulty index, discrimination and reliability. It was found that there was available discrimination at a valid level; 0.35 – 0.79. There was the reliability using the α - Cronbach Coefficient method at 0.959, indicated that all tests of environmental ethics comply with an acceptable value of 0.70 which can be used to collect data with the sample.

4. The Data Collection

4.1) Researchers prepared environmental education teaching plans using Case Study and Games Based Learning for undergraduate students, environmental knowledge test, environmental attitude test and environmental ethics test.

4.2) Take a test before the event using environmental knowledge test, environmental attitude test and environmental ethics test questionnaire to record as score before training or at pretest created by the researcher.

4.3) Conduction as lesson using an environmental education teaching plans using Case Study and Games Based Learning for undergraduate students and sample group in the study were 81 undergraduate students in Environmental Education program, Faculty of Environment and Resource Studies, Mahasarakham University in the 2nd semester of the academic year 2020. The environmental education teaching plans using Case Study and Games Based Learning for undergraduate students, researcher has applied from theory of SukonSinthapanon [6]and TissanaKhammanee [5]. There are steps as follows:

Step 1. Teaching preparation;instructors set clear case study and games to be consistent with the purpose of the learners set by the teacher for learners to study case study and games play by dividing learners into groups as appropriate.

Step 2. Game play;the teacher presents the game. explain how to play and rules of play learners play the game according to the rules. Instructors and learners discuss the outcomes of the games and the methods or behaviors of the learners. The teacher evaluates the learning outcomes of the learners.

Step 3.Case study preparation;the teacher presents a case study about the environment using media such as video media. and the knowledge sheet for the lesson plan for learners to study during the lecture which consists of a total of 8 lesson plans as well as to take the knowledge test during the teaching activities of 5 items as in Table2.

Step 4.Analysis stage;when learners have studied from lectures and case studies. Ask each group of students to discuss, brainstorm, analyze and express their opinions about the case study, for each group of learners to jointly decide to find solutions summarize the results and discuss the results of members within the group.

Step 5.Conclusion, the students in the class work with the teacher to discussion the cause of the problem and guidelines for decision-making to solve problems from case studies that teachers have formulated about the environment consistent with the objectives that the teacher has set.

Step 6. Evaluation; instructors assess learners based on answer questions. and observation of students participation in the class from responses, answer questions, and reporting that students present in front of the class. Working as a group of students and exercises at the end of the chapter after the class.

4.4) After completing all 8 lesson plans, take a post-test with the environmental knowledge test, environmental attitude test and environmental ethics test.

Table 1.Environmental education teaching plans using Case Study and Games Based Learning.

Week	Learning activity plans	Case study	Games	Time (hours)
1		Pretest		2
2-3	Plan 1: Waste management	The model village of solid waste management in Ban Tha community, Uttaradit province.	Garbage sorting game	4
4-5	Plan2: Soil management	The development of good agricultural soil by soil volunteer doctors.	Soil picking put bottle game	4
6-7	Plan3: Water management	Flood-Drought management project with groundwater replenishment innovation.	Bring water home game	4
8	Plan4: Wildfire management	Wildfire of PhuKradueng National Park.	Forest fire extinguisher hint game	2
9-10	Plan 5: Forest conversation	Economic value wood.	Tree jigsaw game	4
11-12	Plan 6: Waste water management	Wastewater treatment project using Makkasan Swamp Plants, Bangkok	Balloon support game	4
13	Plan 7: Global warming	Global warming warning against marine animals	Snake ladder save the world game	2
14	Plan 8:Sufficiency economy philosophy	The modelvillageof sufficiency economy in Ban Ton Han community	Sufficiency economy	2

Week	Learning activity plans	Case study	Games	Time (hours)
15		Posttest	game	2
		Total		30

5. The Research Statistics

The data were analyzed by the statistics as follows: 1) Basic statistics were frequency, percentage, mean and standard deviation. 2) The suitability of the environmental education teaching plans using case study and games based - learning for undergraduate students. 3) Conformity index value. 4) Difficulty of environmental knowledge test. 5) The discriminant power of test. 6) Confidence value. 7) Process efficiency value (E_1). 8) Result efficiency value (E_2). 9) Effectiveness index (E.I.) 10) Statistics test hypotheses including: Paired t-test, One-Way MANOVA and One-Way MANCOVA.

6. The Research Conceptual Framework

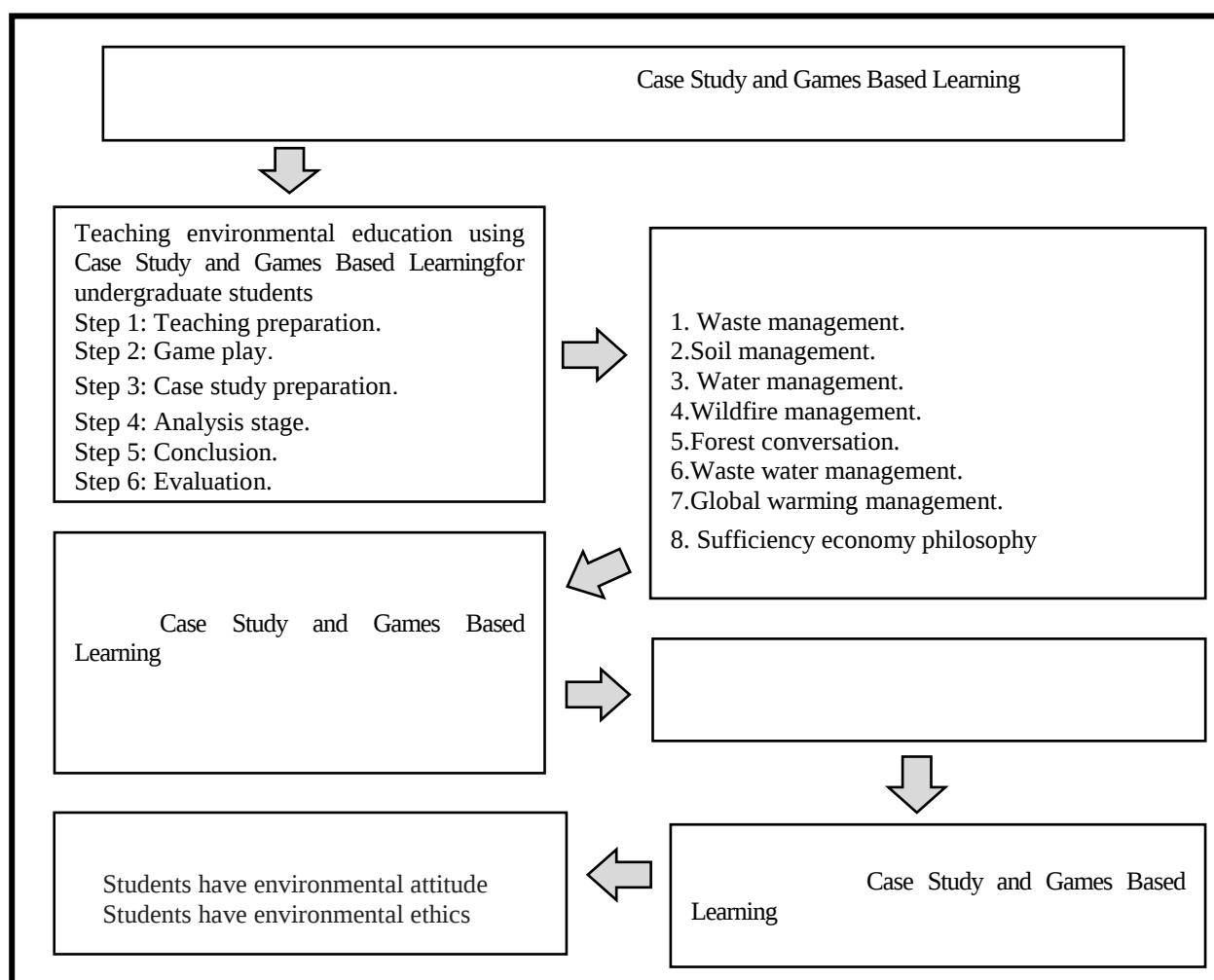


Figure1. The research Conceptual framework.

Results

1. The environmental education teaching plans using Case Study and Games Based Learning were efficiency of 88.67/84.22, effectiveness of the activity index was equal to 0.7146. The students had more environmental knowledge and effected to increased students progress after learning at 71.46 percent.

2. The comparison of average scores for environmental knowledge, environmental attitude and environmental ethics of the students at pretest and posttest, was found that:

2.1) The undergraduate students has an average score of environmental knowledge of the pretest was at the moderate level ($\bar{x}$ = 17.88) and of the posttest was at the highest level ($\bar{x}$ = 33.69). At the posttest, they had higher average score of environmental knowledge than the pretest statistically significant ($p < .05$) as showed in Table 2.

2.2) The undergraduate students has an average score of environmental attitude of pretest was at the neutral level ($\bar{x}$ = 2.64) and of the posttest was at the strongly agree level ($\bar{x}$ = 4.23). At the posttest, they had higher average score of environmental attitude than the pretest statistically significant ($p < .05$) as showed in Table 2.

2.3) The undergraduate students has an average score of environmental ethics of the pretest was at the level for rightness and goodness ($\bar{x}$ = 2.24). and of the posttest at the level for relatives and friends ($\bar{x}$ = 3.35). At the posttest, they had higher average score of environmental ethics than the pretest statistically significant ($p < .05$) as showed in Table 2.

Table 2. The comparison of an average score for environmental knowledge, environmental attitude and environmental ethics of the students at the pretest and the posttest using t-test.

Item	Pretest			Posttest			t	df	p
	$\bar{x}$	S.D.	Level	$\bar{x}$	S.D.	Level			
Environment knowledge (N = 40)	17.88	1.21	Moderate	33.69	1.68	Highest	-67.914	80	.000*
Environmental Attitude (N = 5)	2.64	0.08	Neutral	4.23	0.08	Strongly agree	-118.746	80	.000*
Environmental Ethics (N = 4)	2.24	0.16	Ethics for relatives and friends	3.35	0.14	Ethics for correctness and goodness	-44.205	80	.000*

*Statistically significant.05

3. The comparison of an average score for environmental knowledge, environmental attitude and environmental ethics among the undergraduate students with different gender using One-Way MANOVA and One-Way MANCOVA, found that there was no difference of an average score of environmental knowledge, environmental attitude and environmental ethics of students with difference gender as showed in Table 4-5.

Table 3. The comparison of an average score for environmental knowledge, environmental attitude and environmental ethics among the students with different gender using One-Way MANOVA.

Test statistics	Value	Hypothesis df	Error df	F	p
Pillai's Trace	.024	3.000	77.000	0.632	.597
Wilks' Lambda	.976	3.000	77.000	0.632	.597
Hotelling's Trace	.025	3.000	77.000	0.632	.597
Roy's Largest Root	.025	3.000	77.000	0.632	.597

Table 4. The comparison of average score for environmental knowledge, environmental attitude and environmental ethic among the students with different genders using One-Way MANCOVA using the pre-test score as covariates.

Early variant	Dependent variable	SS	df	MS	F	p
Gender	environmental knowledge	3.010	1	3.010	1.056	.307
	environmental attitude	.002	1	.002	.322	.572
	environmental ethic	.001	1	.001	.062	.804

Discussions

1) The environmental education teaching plans using Case Study and Games Based Learning for undergraduate students were efficiency of 88.67/84.22, effectiveness of the activity index was equal to 0.7146. After learning, the students had more environmental knowledge and effected to increased students progress at 71.46 percent. It is affecting from using environmental education teaching plans using Case Study and Games Based Learning for undergraduate students consisting of 8 plans that the researcher has created through the examination of advisors and through the examination of tools from 5 experts. Which has the suitability at the most appropriate level. In addition, teachers have used the process of environmental education teaching plans using Case Study and Games Based Learning for undergraduate students, it consists of 6 steps; step 1: teaching preparation, step 2: game play, step 3: case study preparation, step 4: analysis stage, step 5: conclusion, and step 6: evaluation. This causes the learners to gain knowledge, understanding and interest. The instructor will raise case study so that students can see the importance and be able to think critically about the environment and after studying the students will have more knowledge. Demonstrates the progress of the learners and environmental education teaching plans using Case Study and Games Based Learning for undergraduate students with efficiency and effectiveness according to the set criteria. The efficiency must take into account the operations that can be achieved in accordance with the specified objectives. However, it requires various resources cost-effectiveness and efficiency is a consideration of the process of operation rather than the productivity of the performance study of the lesson plan [9]. The effectiveness section is the ability to achieve project objectives or goals consideration of options. Using effectiveness is a criterion by analyzing how much or not that choice can achieve the objective by comparing the actual results in terms of units of product or service with expected spontaneous consequences [10]. Which teaching case study is teaching that takes the situation or problem to provide an example for learners to study, analyze and discussion to create understanding and make a rational decision-making [6]. Using games as process in which learners have a role to play in playing games based on simulated situations help the learners achieve the specified objectives and can be used in discussions to summarize learning activities [5]. Environmental knowledge transfer is process for people to have knowledge about the environment [3]. This is consistent with the research of Prayoon Wongchantra, Wannasakpijitboonserm, Kautentean Wongchantra, Kannika Sookngam and Paweena Phumdandin [11] found that teaching environmental education using case studies-based learning method efficiency was 98.00/87.00 and the effectiveness index was 0.7961. It was students participating in the teaching environmental education using case studies-based learning method is the progress in the percent 79.61. And Jiranoot Thinkamchoet and Prayoon Wongchantra [12] found that the performance of the camp activity manual was the 90.04/83.44 which according to the criteria set and index the performance of the guide camp activities natural resources and environment of ASEAN was 0.6670, it was youth participating in the ASEAN environment and resources camp by using the manual camp activities natural resources and environment of ASEAN is the progress in the percent 66.70. And Suwakhon Phakeewai and Prayoon Wongchantra [13] found that the manual was the most appropriate and evaluate the efficiency and effectiveness of environmental recreation camp activities. The efficiency was 85.17 / 83.44 and the effectiveness index was 0.6117. Therefore, environmental education teaching plans using Case Study and Games Based Learning for undergraduate students is one of the teaching processes that can enable students to achieve learning success and increase learning progress.

2) The comparison of an average score for environmental knowledge, environmental attitude and environmental ethic of the students at the pretest and the posttest, found that;

2.1) The students had environmental knowledge of posttest at higher than pretest, as a result of an environmental education teaching plans using Case Study and Games Based Learning for undergraduate students, it is an effective and effective lesson plan according to the criteria. Resulting from the formatting of the lesson plan to have complete content and in accordance with the objectives by bringing the body of knowledge about the environment, consisting of 8 plans, which emphasize the process of knowledge transfer by using the technique of raising case study about the environment and playing games integration with the process of transferring environmental education in teaching and learning activities. The researcher has applied and develop learning processes. There are 6 steps: Step 1: Teaching

preparation, Step 2: Game play, Step 3: Case study preparation, Step 4: Analysis stage, Step 5: Conclusion, and Step 6: Evaluation to enhance the body of knowledge to have fun and enjoyment while studying as a result, students become more interested and have more knowledge after studying. Through the process of transferring knowledge on the environment in order to educate people about the environment, attitudes and values that are good for the environment [3] by bringing stories or problems that may arise in real life to study learners have commented analyze the discussion to create understanding and lead to decision-making to find a rational solution [14]. Which teaching using games must allow learners to understand and understand basic skills and have fun enjoying the game. So, teaching must be carried out in accordance with its intended purpose [15] which tools to measure knowledge is behavior from learning must rely on the achievement test, which will be a measure of knowledge various skills and competencies [16]. This is consistent with the research of Prayoon Wongchantra [17] found that the students in the experimental group who participated development of an environmental education teaching process by ethics infusion method for undergraduate students. It showed that after the learning, students had statistically significantly higher environmental knowledge mean score than before learning. And Prapatsorn Kleebrathum [18] found that on the post-test, students had higher mean score of instructional management by using case study than on the pre-test. And Tanwalai Kullrawong and Orapin Sirisamphan [19] found that before the learning, students had the learning achievement on the environmental crises gained by using case study and problem solving higher than before the learning. And Worawat Chanwirat, Prayoon Wongchantra and Wutthisak Bunnaen [20] found that at the posttest, the students had higher average scores of knowledge of environmental development, occupational health than at the pretest statistically significance ($p < 0.05$). And Ariya Wongphimsorn and Prayoon Wongchantra [21] found that after the training, students had more mean score of knowledge about green university management in campus, energy, waste, water, transportation and education than before the training. And Jackrit Thinkhamchoet, Prayoon Wongchantra and Wutthisak Bunnaen [22] found that after the training, students had higher mean score of knowledge about environmental conservation than before the training. Therefore, students who study using cases study and games based learning, resulting students have a greater understanding of the environment.

2.2) At the posttest, students had environmental attitude higher than the pretest. It is affecting from environmental education teaching plans using Case Study and Games Based Learning for undergraduate students about contents of 8 activity plans were waste management, soil management, water management, wildfire management, forest conservation, waste water management, global warming and sufficiency economy philosophy. This is based on the process of environmental education transfer where the researcher inserts case studies and games during the lectures by presenting a case study on the environment in the form of a video enabling learners to analyze situations from teaching activities in order to enhance the experience and express it in terms of emotions, thoughts, feelings and behaviors to treat the environment in a good way. As a result of all students had environmental attitude at higher than before, which attitudes arise from learning or from individual experiences, attitudes it is not an innate thing. If a person is already aware of anything that person will act in a certain way in thought and behavior [23]. Which methods of teaching case studies where situations or case studies are presented or stories. That actually happened or it may happen in real life to be adapted to serve as an example for students to study and analyze. And training students to understand and see the real problem [6]. It is integrated with game-based teaching methods to help learners learn things in a fun and challenging way. In which the students are the players themselves making it gain hands-on experience it is a method that allows students to participate highly [5]. Attitude is a measure that represents the sum of humans regarding feelings, preferences, prejudices, preferences, fears, threats and all obedience to a particular subject Duangduean Phanthumanawin and Penkhae Prachonpachanuk [24]. This is consistent with the research of Kiattisak Charoensook, Prayoon Wongchantra, Banyat Salee and Chaitach Jansamood [25] found that students had average score of total attitude on local vegetable Songkhram watershed conservation of second primary education after training was rated higher than before training ($p < 0.05$). And Jiranoot Thinkamchoet and Prayoon Wongchantra [12] found that after the training, the youth had higher mean score of attitude than before the training. And Jim Flowers, Cale Rauch, & Alexander Wierzbicki [26] found that after the teaching, students had more mean score of environmental attitude about designed and created products recycled from postconsumer materials than before the teaching. And Ariya Wongphimsorn and Prayoon Wongchantra [21] found that after the training, students had more mean score of attitude to the green university management in campus, energy, waste, water, transportation and education than before the training. Therefore, learning environmental education using Case Study and Games Based Learning. This makes students had environment attitude increase.

2.3) The students had environmental ethics at the posttest higher than the pretest, as a result of the process of organizing activities for teaching and learning environmental education using Case Study and Games Based Learning. There is a process of transferring environmental education by using a lesson plan consisting of 8 plans by presenting a case study in the form of a video on the current environment in conjunction with recreational activities, to encourage learners to have fun and to make learners interested in activities created. It also reflects the idea that students are encouraged to develop environmental ethics and have good behavior in order to express themselves towards the environment. As a result, students have environmental ethics after studying at the level for rightness and goodness, which environmental ethics is the principle that should behave towards the natural environment in order for the natural environment to exist in accordance with the balance of the natural environment that is harmoniously and sustainably [27]. In addition, environmental ethics is also a principle of environmental practice for human beings that upholds the integrity. Correctness according to moral principles and kindness that should be treated with the environment [2]. The process of environmental education is to provide knowledge through to the target population. by any means that can let knowledge flow the target population will obtain knowledge, understanding of the environment and the ability to think, act and solve environmental problems[27]. The case study presented based on current and interesting facts in accordance with the theory and then adapted to teach the learners to achieve the specified objectives [28] and play games cause fun cheerfulness is exercise to develop creativity have the opportunity to change knowledge and learning experiences with others[29]. This is consistent with the research of PrayoonWongchantra[17]found that the students in the experimental group who participated development of an environmental education teaching process by an ethics infusion method for undergraduate students. It was students had a statistically significantly higher environmental ethic mean score after learning than before learning .05.AndKannikaSookngamPrayoonWongchantra and WutthisakBunnaen[30]found that the students had an average score of environmental ethics about soil, water and forest conservation on the concept of The King Rama IX after the training more than before training at the level of statistical significance .05.And WorawatChanwirat, PrayoonWongchantra and WutthisakBunnaen[20] found that average scores on environmental ethics of environmental development, occupational health at posttest were significantly improved when compared to those at pretest ($p < 0.05$).And UraiwanPraimee and WannasakpijitBoonserm [31] found that after the learning, students had more meanscore of environmental ethics than before the learning. And LikhitJunkaew, PrayoonWongchantra and WutthisakBunnaen [32] found that after the learning, the students had more mean score of environmental ethics about KhokHin Lad community forest than before the learning. Therefore, learning environmental education using Case Study and Games Based Learning makes students had the environment ethics increase.

3) There was no difference of an average score of environmental knowledge, environmental attitude and environmental ethics of the students with different gender. It showed that gender factor does not affect knowledge, attitudes and environmental ethics. There is a teaching and learning environmental education using Case Study and Games Based Learning of 8 activity plans, which is an important medium for transferring knowledge that will enable students to acquire knowledge according to their goals. Including the process used in teaching and learning that can be practiced by all genders at an individual level no differences gender were involved make no difference. Which knowledge is an elementary behavior that learners only need to this may be recognizable or by sight, hearing, remembering. This level of knowledge includes knowledge of definitions, meanings, facts, rules, structures and solutions comprehension may manifest in translational skills [33]. The attitude that is rooted in the faith may affect behavior in the future, attitude is just the readiness to respond to stimuli and is a dimension of assessment to show likes or dislikes about an issue. Which is considered internal communication with the effect from exposure that will affect behavior [34]. The environmental ethics it is a principle that one should behave towards the environment, which has resulted in the existence of the environment in ecological equilibrium not losing the relationship between oneself and the environment[27]. And Yang chu Yingyang, CharinMangkhang and JaruneeManeeikul[35] found that there was no difference of students with different gender in support of environmental conservation activities from school and environmental literacy in mean environmental ethical behaviors. AndPhraThepsureeChankao and PiyapongJanmaimool[36] found that there was no significant difference of students with different gender in Wat Changron school, Ratburanadistrict, Bangkok after participating in the learning activities.And CeylanGuriçin Omer SeyfettinSevinç[37]found that there were no different of a level of environmental ethics of male and female teachers. And JiranootThinkamchoet and PrayoonWongchantra[12]found that there was no different of knowledge of natural resources and environmental conservation in the ASEAN of youths with different gender. And LikhitJunkaew,PrayoonWongchantra and WutthisakBunnaen[32] found that there was no different of knowledge of KhokHin Lad community forest between of students with different gender. AndSuparatOngon, PrayoonWongchantra and WutthisakBunnaen[38] found that there was no significant difference between average score of the environmental ethics about integrated instructional activities of environmental education by using community - based learning and active learning of undergraduate students with different gender. And JackritThinkhamchoet,

PrayoonWongchantra and WutthisakBunnaen [22] found that there was no significant difference of average score of knowledge about environmental conservation and environmental ethics students with different gender. And WorawatChanwirat, PrayoonWongchantra, WutthisakBunnaen [20] found that there was no significant difference of knowledge about environmental development, occupational health, and environmental ethics of male and female students. Therefore, it was shown that both male and female students who had environmental education using Case Study and Games Based Learning.

Conclusion

The effect of environmental education teaching using Case Study and Games Based Learningfor undergraduate students as follows:

First, the environmental education teaching plans using Case Study and Games Based Learningfor undergraduate students were efficiency of 88.67/84.22, effectiveness of the activity index was equal to 0.7146. The students had more environmental knowledge and effected to increased students progress after learning at 71.46 percent.

Second, after the learning, the students had an average score of environmental knowledge, environmental attitude and environmental ethics higher than before the learning with the statistically significance level.05.

Third, there was no difference of an average score of environmental knowledge, environmental attitude and environmental ethics of the students with different gender.

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References

- [1] Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment. (2006). *Environmental Quality Situation Report 2005*. Bangkok: Rattaya Printing.
- [2] WinaiWeerawattananon. (2003). *Environmental Studies*. 3rd edition, Bangkok: O.S. Printing House, 43.
- [3] PrayoonWongchantra. (2012). *Environmental Studies*.Mahasarakham, Mahasarakham University Press.
- [4] PrayoonWongchantra. (2016). *Environmental Education*.Mahasarakham. Kakayia Publisher.
- [5] TissanaKhammanee. (2007). *Various alternative teaching styles*. 2nd edition. Bangkok, Chulalongkorn University.
- [6] SukonSinthapanon .et al. (2002). *Organizing the learning process: focus on the learners according to the basic education curriculum*. Bangkok: Aksorn Charoen Tat.
- [7] UthumphonPailin. (1998). *Knowledge, attitudes and practice of Prathomsuksa6 students towards environmental conservation of BuengBoraphet. Nakhon Sawan Province*. Master's Thesis (Environmental Studies). Bangkok: Graduate School Mahidol University.
- [8] KanlayaVanichbuncha. (2002). *Statistical analysis: Statistics for services and research*.3rd edition,,: Thammasarn Company.
- [9] NonglakYutthipong. (2007). *A Study of Management Conditions According to Good Governance Principles of Educational Institutions in Supervisory District 13*.UbonRatchathani : Office of the Office of the Permanent Secretary, Ministry of Education.
- [10] Supachai Yawaprapha. (2011). *Public policy*.9th edition. Bangkok : Publisher of Chulalongkorn University.
- [11] PrayoonWongchantra, Wannasakpijitroonserm, KautenteanWongchantra, KannikaSookngam and PaweenaPhumandin. (2016). Teaching environmental education using case studies-based learning method. *Proceeding of the National Research Conference Northem College Northern Research 3rd "Value-added research economic development"*. 33-40.

- [12] JiranootThinkamchoet and PrayoonWongchantra. (2018). The development of camp on natural resources and environmental conservation in the ASEAN for youths in Roi-et province. *International Journal of Agricultural Technology*. 14(7). 2077-2096.
- [13] SuwakhonPhakeewai and PrayoonWongchantra. (2020). The Development of Environmental Recreation Camp Activities for Youth in Roi-Et Province of Thailand. *World Journal of Education*.10(4), 94-103. <https://doi.org/10.5430/wje.v10n4p94>.
- [14] OngchatKongchat. (2001). *A Study of Learning Achievement and Descriptive Thinking of Vocational Certificate Level 1 Students studying Social Studies By teaching it using plotting techniques and example techniques*. (Master's thesis). Bangkok: Srinakharinwirot University.
- [15] YaowapaDechagupta. (2003). *Games and play for early childhood*. Bangkok. 61-62.
- [16] WichianKetsing. (2015). *Mean and translation*. Bangkok, Sod Sri Sarit Wong Foundation.
- [17] PrayoonWongchantra. (2009). Development of an environmental education teaching process by an ethics infusion method for undergraduate students. *University of the Thai Chamber of Commerce Journal*. 29(1). January - March. 77-91.
- [18] PrapatsornKleebprathum. (2018). Effects of Case Study on Learning Achievement and Satisfaction towards the Leadership Development Course, Kamphaeng Phet Rajabhat University. *The 3rd KRU NATIONAL ACADEMIC CONFERENCE*. 474-482.
- [19] TanwalaiKullrawong and OrapinSirisamphan. (2015). The development of learning achievement and problem solving abilities on the environmental crisis of mathayomsuksa 2 students using case study and problem solving. *Veridian E-Journal, Slipakorn University*. 8(2); May-August. 1735-1748.
- [20] WorawatChanwirat, PrayoonWongchantra and WutthisakBunnaen. (2021). The Effect of Environmental Education Activities for the Developing Environment and Occupational Health in School. *Annals of Romanian Society for Cell Biology*. 25(5). 4959–4969.
- [21] Ariya Wongphimsorn and PrayoonWongchantra. (2021). The Effect of Training Course Development of Green University Management in Campus, Energy, Waste, Water, Transportation and Education. *Annals of Romanian Society for Cell Biology*. 25(5). 4879-4890.
- [22] JackritThinkhamchoet, PrayoonWongchantra and WutthisakBunnaen. (2021). The Effects of Environmental Conservation School Activities Development Using Team Work Based Learning (TWBL) for Students of MuengRoi-Et Municipality Schools, Thailand. *Annals of Romanian Society for Cell Biology*. 25(5). 5448-5464.
- [23] PinyoPrakobphol. (1995). *Attitudes of Provincial Council members and government officials involved in the performance of the Provincial Administrative Organization*. Master of Science in Development Administration. Bangkok: National Institute of Development Administration.
- [24] DuangdueanPhanthumanawin and PenkhaePrachonpachanuk (1977). *Ethics of Thai youth*. Bangkok: Srinakharinwirot University, Prasanmit, Behavioral Science Research Institute.
- [25] KiattisakCharoensook, PrayoonWongchantra, BanyatSalee and ChaitachJansamood. (2013). The Effect of Training on Local Vegetable Songkhram Watershed Conservation for Second Primary Education in Srisongkhram District Nakhonphanom Province. *European Journal of Scientific Research*. 116(1).144-147.
- [26] Jim Flowers, Cale Rauch and Alexander Wierzbicki. (2018). Teaching Upcycling to Impact Environmental Attitudes. *Journal of Technology Education*. 30(1). 30-45.
- [27] PrayoonWongchantra. (2011). *Environmental Studies*.Mahasarakham, Mahasarakham University Publisher.
- [28] ManopHangpai. (2013). *A study of the achievement of using case studies in teaching, advertising and Promote the sales of students*. Chiang Rai Graduate School, Chiang Rai Rajabhat University
- [29] SuwitMoonkham and OrathaiMoonkham. (2002). *21 How to Manage Learning for Developing the Thinking System*. Bangkok: Phapim.
- [30] KannikaSookngam, PrayoonWongchantra, WutthisakBunnaen. (2021). The Effect of Environmental Education Training Course in Soil, Water and Forest Conservation on the Concept of The King Rama IX of Thailand. *International Journal of Higher Education*. 10(4). 32 – 48. <https://doi.org/10.5430/ijhe.v10n4p32>.
- [31] UraiwanPraimeeand WannasakphijitBoonserm. (2021). The Effects of Learning Activities on Waste and Sewage Management Using Question and Problems-Based Learning for Undergraduate Students of Mahasarakham University, Thailand. *Journal of Educational Issues*. 7(1). 72-91. <https://doi.org/10.5296/jei.v7i1.18267>.
- [32] LikhitJunkaew, PrayoonWongchantra, WutthisakBunnaen. (2021). The Effects of Environmental Education Learning Activities Using Area-Based Learning in KhokHin Lad Community Forest in MahaSarakham, Thailand. *World Journal of Education*. 11(2). 56 - 71. <https://doi.org/10.5430/wje.v11n2p56>.

- [33] AksornSawatdee. (2009). *Knowledge and panic in the conservation of the environment. High school students: a case study in Bangkapi district, Bangkok*. Master of Arts Social Development Branch: Faculty of Social Development, National Institute of Development Administration.
- [34] Rogers, D. (1978). *The psychology of adolescence*. New York: Appleton Century-Crofts.
- [35] Yang Chu Yingyang, CharinMangkhang and JaruneeManeeekul (2019). Literacy and Environmentally Ethical Behaviors of Secondary School Students in China. *Journal of Graduate MCU KhonKaen Campus*. 6(3), 137-151.
- [36] PhraThepsureeChankao and PiyapongJanmaimool. (2020). Organization of Learning Activitiesabout “Solid Waste Management” for Enhancing Senior Elementary Students’ Knowledge, Awareness, and Engagement in Municipal Solid Waste Management: A Case of Wat Changron School, Ratburana District, Bangkok. *E-Journal of Education Studies, Burapha University*. 2(1); January - March.
- [37] CeylanGüriçin, ÖmerSeyfettinSevinç. (2020). Determination of Teacher Candidates’ Awareness of Environmental Ethics. *International Journal of Contemporary Educational Research*. 7(1), 346-361. <https://doi.org/10.33200/ijcer.643329>.
- [38] SuparatOngon, PrayoonWongchantra, WutthisakBunnaen. (2021). The Effect of Integrated Instructional Activities of Environmental Education by Using Community - Based Learning and Active Learning. *Journal of Curriculum and Teaching*. 10(2): 42-57. <https://doi.org/10.5430/jct.v10n2p42>