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Creating Awareness of Natural Resources Conservation in the Agricultural School Network

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Abstract

This research aimed to explore the challenges and methods for raising awareness about natural resource conservation within the agricultural school network. It also sought to study the approaches used by agricultural student teachers to foster this awareness and to observe the behavior of students regarding natural resource and environmental conservation. The research was conducted in two phases. The first phase focused on identifying problems and methods for conserving natural resources and the environment in schools. The second phase utilized participatory action research to enhance awareness of natural resource and environmental conservation. In the first phase, data were collected through questionnaires and interviews involving 23 teacher mentors, 19 student teachers, and 14 KMITL supervisors. In the second phase, unstructured interviews and focus groups were conducted with five student-teacher volunteers and their mentors. The findings revealed that schools faced moderate issues related to natural resources and the environment but had high-level guidelines for conservation and awareness-raising. Student teachers effectively promoted awareness by integrating agricultural content, engaging in various activities, and using positive reinforcement. Conservation methods included economical use, reuse, and substitution with alternative materials. The study found that students' behaviors towards natural resource and environmental conservation improved significantly when guided by student teachers.

Introduction

Thailand has experienced rapid economic expansion and technological advancements. However, as a result, its agricultural natural resources have begun to deteriorate significantly. Soil resources have become infertile, and the use of chemical fertilizers has altered the soil structure. This deterioration is due to a lack of knowledge in restoring and maintaining natural ecosystems (Sawamechai, 2016). There is a shortage of water because of unseasonal rain and periods of dry spells. The expansion of communities and economic activities also affects the ecosystem of the basin, including the potential of the area to develop water reservoirs that are able to store enough water to meet the needs of surrounding communities (Vachirasirodom, 2022). The occurrence of garbage rafts longer than 10 kilometers in the offshore sea of Chumphon Province is alarming (Buakamsri, 2017). The majority, 80%, of all

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waste comes from households that leave garbage along roadsides, while the remaining 20% comes from riverside, beachside communities, and fishing boats. Research has shown that microplastics contained in plankton are the starting point of the food chain, eventually consumed by larger fish. Ultimately, these contaminants reach humans who eat these fish and other sea creatures (Thaipublica, 2017). This highlights the importance of preserving the natural environment in Thai society. Schools lack awareness of conserving natural resources and the environment. Teachers do not emphasize instilling this awareness in students. Classrooms lack an atmosphere that highlights the value of natural resources and the environment, and educators struggle to integrate this content effectively (Chureegate & Worawan, 2016). If this continues, the next generation may permanently destroy natural resources. Consequences could include topsoil erosion, landslides, floods, infertile soil, deteriorating water quality, chemical contamination, wildlife migration, extinction of natural vegetation, ecosystem deterioration, and exacerbation of the greenhouse effect.

Teaching and learning related to natural resources are most prominent in agriculture. Agricultural courses teach students how to use land and water effectively for producing food, clothing, shelter, and medicine. The Office of the Vocational Education Commission, under the Ministry of Education in Thailand, offers a vocational certificate course in agriculture. This course aims to preserve natural resources, the environment, and ecosystems. These courses are taught in agricultural and technology colleges nationwide, attracting students from agricultural family backgrounds.

If teachers emphasize the importance of conserving natural resources and the environment during these agricultural courses, graduates will use their knowledge, skills, and awareness to practice conservation in their agricultural work. The Department of Agricultural Education (AgEd) within the Faculty of Industrial Education and Technology (IET) at King Mongkut's Institute of Technology Ladkrabang (KMITL) offers a Bachelor of Education in Industrial Education program. This program focuses on training students to become agricultural teachers throughout Thailand. Therefore, agriculture lecturers at the Department of Agricultural Education play a crucial role as role models in instilling a conservation mindset in agricultural youth.

Objectives

1. To explore the problems and identify ways to raise awareness of natural resource conservation in colleges of agriculture and technology, and
2. To study methods for raising awareness of natural resource conservation among student teachers

Conceptual Framework

Important agricultural and environmental problems in Thailand include issues with soil and water resources. Soil problems encompass a lack of organic matter, sandy soil, salty soil, acidic soil, soil erosion, and rocky highland soil. Water resource problems involve water shortages, flooding during the rainy season, and pollution (Simachaya, 2017; Suwannarat, 2015).

There are many ways to conserve natural resources and the environment, such as economical use, reuse, restoration, rehabilitation, substitution, and prevention (Ratanalertnusorn, 2007).

Meepradit (2016), Chureegate & Worawan (2016), and Matiko (1992) have provided guidelines for raising awareness in preserving natural resources and the environment as follows:

- Insertion of cultivating consciousness for all students in every opportunity within the school,
- Participation in creating a sense of responsibility,
- Suggestions on recovery of natural resources and environment,
- Recommendations on guidelines for compliance with sustainable development principles,
- Arranging time for studying the type of natural resources, ecology system, and the relationship between human and environmental survival,
- Suggestions to students on how not to destroy natural resources and the environment both directly and indirectly,
- Suggestions to students on how to use natural benefits,
- Convincing students to become conservative and disseminate the conservation of natural resources and environment to families and communities in which they live, and
- Induction and collaboration with students in activities that are conducive to the environment.

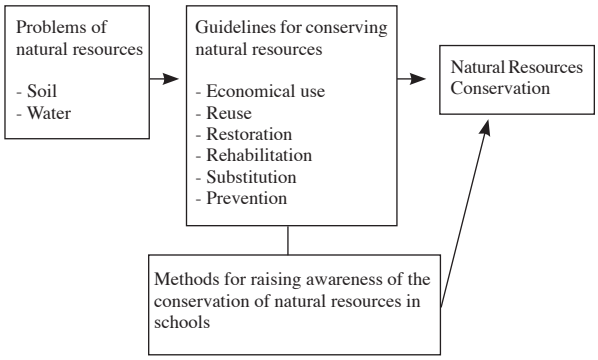

Figure 1 Conceptual Framework

Based on Figure 1, natural resource problems such as issues with water and soil can be addressed through various methods, including economical use, reuse, restoration, rehabilitation, substitution, and prevention. The key to solving these problems sustainably is to develop diverse methods to create awareness of nature conservation in the new generation, ensuring the conservation of natural resources in the future.

Research Methodology

The research is divided into two phases. The first phase is to explore problems and identify ways to conserve natural resources and the environment in schools. The second phase is the use of participatory action research to raise awareness of preserving natural resources and the environment in schools.

Phase 1: Survey Problems and Guidelines

This step was to study the problems and guidelines for conserving natural resources in schools with 3 target groups: teacher mentors, student teachers, and KMITL supervisors.

Teacher Mentors.

23 teachers from 8 Colleges of Agriculture and Technology in Thailand mentored student teachers from the Department of Agricultural Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang ("schools"). The research tool employed was a questionnaire that was first evaluated by 3 experts and then improvements were made to the questionnaire based on expert's comments. The questionnaire is divided into two parts. Part 1 is composed of general information about the respondents including gender, age, teaching experience, and courses taught: Part 2 consisted of problems and guidelines for the conservation of natural resources and the environment. It is characterized by five-levels of agreement: most disagree, disagree, neutral, agree, and most agree. Data was analyzed by mean and standard deviation.

Student Teachers.

They were 19 students of the Department of Agricultural Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang who practiced teaching in the colleges of agriculture and technology. Questionnaires were used to collect data from them. The questionnaire is the same as the mentor teacher's questionnaire. Statistics used in data analysis were mean and standard deviation.

The mean, standard deviation, and T-test were used to compare problems and approaches for raising awareness of natural resources and environmental conservation between teacher mentors and student teachers.

KMITL Supervisors.

There were 14 lecturers from the Department of Agricultural Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang who supervised the student teachers. The research instrument used was an interview about instilling awareness among learners about the conservation of natural resources and the environment. Data were analyzed using content analysis and frequency.

Phase 2: Participatory Action Research

The target group for phase 2 was five student teachers and mentors from 4 Colleges of Agriculture and Technology, namely Phetchaburi Colleges of Agriculture and Technology, Ratchaburi Colleges of Agriculture and Technology, Chonburi College of Agriculture and Technology, and Suphanburi College of Agriculture and Technology. Unstructured Interviews and focus groups were used as research tools. Content analysis and frequency were applied in data analysis.

In this phase 2, Four Moments of Action Research (Kemmis et al., 2004) was applied to collect data as follows:

Plan (P).

The researcher concluded a guideline to raise awareness of the conservation of natural resources and the environment from the initial stage. The operations were carried out as follows:

a. The researcher asked the student teachers to volunteer in participation action research. 5 student teachers volunteered in this research from 4 Colleges of Agriculture and Technology, namely Phetchaburi College

of Agriculture and Technology, Ratchaburi College of Agriculture and Technology, Chonburi College of Agriculture and Technology, and Suphanburi College of Agriculture and Technology.

b. The researcher distributed documents and trained all 5 student teacher volunteers about problems and ways to conserve natural resources and the environment. In addition, the researchers trained the volunteers on the concepts and procedures for conducting classroom research to raise awareness of the conservation of natural resources and the environment for students in the College of Agriculture and Technology.

c. The researcher, the 5 volunteer student teachers, and their teacher mentors jointly planned to raise awareness of the conservation of natural resources and the environment for students at the College of Agriculture and Technology.

Action (A).

All 5 student teacher volunteers proceeded as planned in raising awareness of the conservation of natural resources and the environment for students at the College of Agriculture and Technology.

Observation (O).

The researcher advised all 5 student teacher volunteers on how to raise awareness about conserving natural resources and the environment for students at the College of Agriculture and Technology.

Reflection (R).

The researcher interviewed all 5 volunteer student teachers about the results of the process to raise awareness about preserving natural resources and the environment for students at the College of Agriculture and Technology.

The researcher, together with all 5 volunteer student teachers, summarized the results of the operation to raise awareness about conserving natural resources and the environment for students at the College of Agriculture and Technology.

Results

The research results showed that mentor teachers and student teachers shared the same opinions about the problems and solutions related to soil and water in schools. The majority of KMITL supervisory teachers recommended creating awareness about conserving natural resources by including relevant content in lessons. Volunteer student teachers then taught methods for conserving natural resources and the environment through efficient resource use, reuse, and the use of substitutes. Their students learned to conserve resources and the environment through participatory teaching techniques, a variety of activities, and positive motivation. Details of the research results are as follows.

Problems and Guidelines for Raising Awareness of the Conservation of Natural Resources and the Environment.

Table 1 Problems related to natural resources and the environment in schools

	Teacher mentor			Student teacher			Total		
	Mean	**S.D.**	**Meaning**	**Mean**	**S.D.**	**Meaning**	**Mean**	**S.D.**	**Meaning**
Soil problems									
Lacks organic matter	3.71	0.90	Agree	3.69	0.82	Agree	3.70	0.85	Agree
Sandy soil	3.67	1.06	Agree	3.26	1.11	Neutral	3.45	1.15	Neutral
Soil erosion	3.29	0.96	Neutral	2.95	1.02	Neutral	3.11	0.99	Neutral
Highland soil with very mixed rocks	3.24	1.26	Neutral	2.95	1.21	Neutral	3.20	1.13	Neutral
Salty soil	2.67	1.11	Neutral	2.82	1.11	Neutral	2.75	1.10	Neutral
Acid soil	2.95	1.12	Neutral	2.65	1.15	Neutral	2.80	1.13	Neutral
Water problems									
Water shortage	3.57	0.81	Agree	3.39	1.15	Neutral	3.47	0.99	Neutral
Flooding in the rainy season	3.14	1.10	Neutral	2.86	1.35	Neutral	3.00	1.24	Neutral
Sewage	2.76	1.18	Neutral	2.60	1.19	Neutral	2.98	1.18	Neutral

Incentive index:
Mean 1.00-1.50 = Strongly disagree (SD), 1.51-2.50 = Disagree (D), 2.51-3.50 = Neutral (N), 3.51-4.50 = Agree (A), 4.51-5.00 = Strongly agree (SA)

From Table 1, the mentors and student teachers had neutral soil problems. There was only one problem that they agreed about which was the soil lacked organic matter. As for water problems, it was found that mentors and student teachers had neutral problems in every item.

Table 2 Guidelines for conserving natural resources and the environment in the schools

	Teacher mentor			Student teacher			Total		
	Mean	S.D.	Meaning	Mean	S.D.	Meaning	Mean	S.D.	Meaning
Guidelines for Soil Conservation									
Select plants that are suitable for soil condition	4.19	0.60	Agree	4.21	0.73	Agree	4.20	0.67	Agree
Plan for the best use of land	3.90	0.70	Agree	3.95	0.76	Agree	3.93	0.73	Agree
Improve soil	3.86	0.85	Agree	4.08	0.79	Agree	3.98	0.82	Agree
Apply crop rotation	3.86	0.91	Agree	3.65	0.83	Agree	3.75	0.87	Agree
Reduce the use of chemicals	3.86	0.79	Agree	3.95	1.02	Agree	3.93	0.90	Agree
Use ground cover plant	3.71	0.96	Agree	3.78	0.80	Agree	3.75	0.87	Agree
Till the soil	3.48	0.75	Neutral	3.82	0.83	Agree	3.66	0.81	Agree
Improve irrigation system	3.19	1.03	Neutral	3.34	1.11	Neutral	3.27	1.06	Neutral
Create a windproof line	2.86	1.11	Neutral	3.08	1.04	Neutral	2.98	1.67	Neutral
Prevent soil pollution by using the law	2.80	1.08	Neutral	3.95	0.92	Agree	3.41	1.15	Neutral
Guidelines for water conservation									
Do not throw garbage in the water	4.24	0.94	Agree	4.08	0.90	Agree	4.16	0.91	Agree
Reduce the use of chemicals	4.19	0.98	Agree	4.04	0.82	Agree	4.09	0.91	Agree
Utilize water for maximum benefit	4.14	0.57	Agree	4.08	0.73	Agree	4.11	0.65	Agree
Plan for the best use of land	4.00	0.63	Agree	3.86	1.01	Agree	3.93	0.85	Agree
Provide adequate water quality	3.90	0.70	Agree	3.82	0.83	Agree	3.86	0.77	Agree
Maintain a natural water source	3.86	0.57	Agree	3.78	0.79	Agree	3.81	0.69	Agree
Arrange irrigation systems for water use such as having containers or reservoirs for reserve	3.52	0.87	Agree	3.78	0.85	Agree	3.66	0.86	Agree
Maintain soil moisture by ground cover plant	3.43	0.87	Neutral	3.82	0.93	Agree	3.64	0.92	Agree
Prevent water pollution	3.38	0.80	Neutral	3.78	0.90	Agree	3.59	0.87	Agree
Recycle water	3.14	1.15	Neutral	3.69	0.87	Agree	3.43	1.04	Neutral
Wastewater treatment	3.14	1.01	Neutral	3.56	1.16	Agree	3.36	1.10	Neutral
Guidelines for the other natural resources and the environment									
Use things economically	4.38	0.59	Agree	4.30	0.70	Agree	4.34	0.64	Agree
Reuse	4.29	0.71	Agree	4.30	0.55	Agree	4.30	0.63	Agree
Repair damaged items to be used again	4.19	0.68	Agree	4.17	0.71	Agree	4.18	0.69	Agree
Encourage students to participate in activities to conserve natural resources and the environment	3.76	0.62	Agree	3.95	0.76	Agree	3.86	0.70	Agree
Surveillance and prevention of environmental damage	3.71	0.64	Agree	3.82	1.02	Agree	3.77	0.86	Agree
Rehabilitation of natural resources and the environment around the school	3.67	0.73	Agree	3.86	0.71	Agree	3.77	0.74	Agree
Use other things to replace the things that damage the environment, such as using cloth bags instead of plastic bags	3.67	0.80	Agree	3.60	0.72	Agree	3.64	0.75	Agree
Use technology to conserve natural resources and the environment	3.33	0.73	Neutral	3.86	0.86	Agree	3.61	0.84	Agree
Create group activities for resources and environmental conservation	3.00	0.95	Neutral	3.04	1.02	Neutral	3.02	0.97	Neutral

From Table 2, most mentors and student teachers agreed with soil conservation guidelines. There were only three neutral items: irrigation system improvements, windbreaks to prevent soil erosion, and prevent soil pollution by using the law. While most of the guidelines for water conservation were agreed upon. Only 2 items were neutral: recycled water and wastewater treatment. The participants mostly agreed on the conservation of natural resources and the environment. Only one item was neutral, create groups for the conservation of natural resources and environmental activities.

From Table 3, the mentor and student teachers were neutral on problems related to natural resources and the environment. While participants agreed to the guidelines for conserving natural resources and the environment, and approaches for raising awareness on the conservation of natural resources and the environment.

Table 3 Comparison of problems and approaches between teacher mentors and student teachers

Items	Teacher mentor			Student teacher			t	Sig.
	Mean	S.D.	Meaning	Mean	S.D.	Meaning		
Natural resource andenvironmental problems								
Soil	3.25	0.74	Neutral	3.09	.89	Neutral	1.937	.171
Water	3.16	.87	Neutral	2.96	.90	Neutral	.20	.889
Guidelines for the conservation of natural resources and the environment								
Soil	3.57	.49	Agree	3.79	.64	Agree	.583	.449
Water	3.72	.46	Agree	3.85	.60	Agree	.583	.449
Others	3.75	.35	Agree	3.83	.59	Agree	3.058	.088

Table 4 Guidelines of KMITL supervisors for instilling awareness among learners

Items	Frequency
Include content about natural resources and environment conservation in the lesson	9
Give examples of environmental problems that arise in daily life as well as suggest ways to solve them	1
Observe and monitor learners on water usage	1
Instruction on the value of wastewater	1
Inform the cause of the pollution problem and recommend solutions	1
Lessons on reducing the use of plastic and encouraging students to bring their own glasses or water containers.	1
Assign learners to explain the integration of the environment around them with their lesson	1
Watch videos related to natural resources	1
Instruction on how to manage waste and encourage learners to	1
separate the types of trash before throwing them into the bin Emphasize zero waste	1

From Table 4, most of the supervisors commented that the approach to instilling the learner awareness in the conservation of natural resources and environment is to insert content in the lessons on natural resources and environment conservation for students.

Methods for Raising Awareness of the Conservation of Natural Resources and the Environment

In Phase 2, the researcher as a university supervisor applied participation action research between the researcher and the student teachers and mentor teachers. The research results are presented as follows:

Plan.

From the conclusion in phase 1, it was found that teacher mentors and student teachers had problems with the natural resources and environment at moderate levels. They agree with the guidelines for conserving natural resources and the environment in the schools. This shows that they have awareness of the conservation of natural resources and the environment. Therefore, the researcher started a research plan to implement methods for raising awareness of the conservation of natural resources and the environment of students as follows:

a. The researcher asked student teachers to volunteer in the research. Five student teachers volunteered to participate in this research from 4 colleges of Agriculture and Technology.

b. The researcher distributed the conclusion derived from the research in phase 1 to the five volunteer student teachers as well as concepts and procedures for conducting classroom research to raise awareness of the conservation of natural resources and the environment.

c. The researcher, together with the 5 volunteer student teachers and their teacher mentors, participated in a meeting to create awareness on the conservation of natural resources and the environment for students at the College of Agriculture and Technology. All agreed that engaging students fosters a sense of responsibility for problems in the conservation of natural resources and the environment.

d. The volunteer student teachers planned to raise awareness of the conservation of natural resources and the environment for students at the College of Agriculture and Technology as follows:

Phetchaburi College of Agriculture and Technology

The volunteer student teacher in this college conducted classroom research on the awareness of water usage of students in Vocational Certificate Level 1/2 in Vegetable Production Course.

Ratchaburi College of Agriculture and Technology

There were 3 classroom research that two volunteer student teachers in this college offered: 1) Water usage in Vocational Certificate Level 2/1 in Vegetable Production Course, 2) Using organic fertilizers in Vocational Certificate Level 1/3 in the Foundation of Agriculture Course, and 3) Attitude toward reuse of matter in Vocational Certificate Level 3/1 in the Mushroom Production course.

Chonburi College of Agriculture and Technology

The volunteer student teacher planned to conduct classroom research on using organic fertilizers in Vocational Certificate Level 2/1 and 2/2 in the course of Soil and Water in Agriculture.

Suphanburi College of Agriculture and Technology

The classroom research that the volunteer student teacher proposed was reuse of plastic nursery bags in Vocational Certificate Level 3/2 in the Ornamental Plant Production course.

Action.

The five volunteer student teachers conducted their classroom research as follows:

Phetchaburi College of Agriculture and Technology

The volunteer student teacher encountered a problem that the college focused on spending time on extracurricular activities rather than teaching time. The volunteer student teacher found that students in the Vegetable Production subject did not pay attention to watering vegetables and she was only able to meet with students a few times. The researcher and her teacher

mentor suggested she encourage students to take care of the vegetable field during extracurricular activities time. Later, in the last 3-4 weeks before the semester break, the students in the class made an agreement with the volunteer student teacher on the use of water and agreed to three actions they would perform. First, they would divide groups responsible for the water shutdown performed by setting up a daily duty of 3 people a day to check the shutdown of all wells. Second, they would not use a hose to water the vegetables. Third, they would water the vegetables with 8 watering cans per plot.

Ratchaburi College of Agriculture and Technology

The first volunteer student teacher conducted two classroom research projects. The first focused on water usage. She and her students devised a solution for saving water when growing vegetables. They used water in a cement pond to clean agricultural tools, then reused the water to irrigate vegetables. However, the leftover water developed a bad odor. The researcher and teacher mentors advised using the water for other plants. Additionally, they recommended using a container to collect water from the tap for cleaning vegetables after harvesting. If the water in the container became soiled, the students were advised to run the tap lightly to expel the dirty water instead of draining it entirely. Despite these measures, some students still used a watering hose, and others neglected to water during the weekends. The researcher and mentors suggested using positive motivation to address these issues. The student teacher assigned students to take pictures of themselves watering vegetables with a watering can and post them to the course's Facebook group. Shortly after, she commented on the posts and displayed the students' scores.

The second research project involved using organic fertilizers instead of chemical ones. The student teacher and her students explored ways to produce organic vegetables. They used supplemental organic fertilizer from a local community enterprise center near Nam Kheang Na, Khao Chong Pran subdistrict, Photharam District, Ratchaburi Province. They experimented with chemical fertilizers, no fertilizers, and supplemental organic fertilizers to grow Chinese lettuce. Some of the lettuce died during the experiment due to insects. The researcher and teacher mentors suggested reducing the number of Chinese lettuce plants in each treatment.

The second volunteer student teacher conducted research on using old planting material to cultivate straw mushrooms. She used sawdust in old mushroom cubes mixed with water hyacinth and banana plants. She encouraged students to research mushroom cultivation and grow a small batch of straw mushrooms. However, students rarely watered the mushrooms. She assigned a watering schedule with two students per day. Another issue was that no students harvested mushrooms in the early morning or on weekends. The researcher and her mentor recommended using positive incentives. She encouraged students to take responsibility by offering points and money earned from selling the mushrooms as rewards for early morning and weekend harvesting.

Chonburi College of Agriculture and Technology

The volunteer student teacher at this college incorporated the use of organic fertilizer into her course. She included information about organic fertilizer in her lectures and assigned her students to use organic fertilizer in their vegetable plots.

Suphanburi College of Agriculture and Technology

At this college, the volunteer student teacher focused on reusing plastic nursery bags as part of her classroom research. She highlighted the waste generated from plastic bags and committed to reusing them for growing ornamental plants. She found that only a few activities used plastic bags for this purpose.

Observation: The results are as follows:

Phetchaburi College of Agriculture and Technology

Before implementing the classroom agreement, 23.53% of students used a watering hose and did not turn off the water after use. By the end of the vegetable planting project, 47.06% of the students demonstrated better responsibility and awareness of water use. They watered the vegetables with eight watering cans per plot and consistently turned off the water after use.

Ratchaburi College of Agriculture and Technology

First Classroom Research:

Before the classroom agreement, none of the students cleaned agricultural tools in the cement pond. After the agreement, 92.85% of the students used the pond for cleaning tools. After harvesting, all students used a basin to clean vegetables without overfilling it.

Second Classroom Research:

Using organic fertilizers resulted in a higher number of leaves, greater height, and larger canopy compared to chemical fertilizers or no fertilizers. Students were curious about the results and collaborated on measuring and documenting the growth of the Chinese lettuce. They took pride in their successful vegetable

cultivation and gained valuable knowledge and a positive attitude from the experiments.

Second Volunteer Student Teacher's Research:

Students developed a positive attitude towards using old agricultural resources for straw mushroom production in terms of economics, society, and the environment (mean 3.26). Economically, they reduced production costs, increased income, and improved mushroom yields by reusing old mushroom lumps, which saved costs and generated 5,800 baht. They gained knowledge about mushroom production and expressed interest in pursuing it as a career. Socially, they solved problems such as distributing unsellable bloomed mushrooms within the college and serving as guest speakers to share their knowledge. Environmentally, they learned to manage agricultural waste and recognized the value of reducing pollution. Students also practiced accounting and working systematically, learning from their mistakes to gain work experience.

Reflection

Feedback from the volunteer student teachers about their classroom research is as follows:

Phetchaburi College of Agriculture and Technology

Basic moral and ethical principles should be incorporated along with establishing a classroom water use agreement. Responsibility and a public mindset will help students become aware of water resource usage. Positive reinforcement encourages students and shows appreciation for their efforts.

Ratchaburi College of Agriculture and Technology

Guidelines for economical water use in vegetable growing should be promoted among college students and applied in other subjects. The use of organic fertilizers instead of chemical ones should also be encouraged. Experiments in producing organic fertilizers will boost students' confidence in using them. Students have learned about water use, organic fertilizers, and straw mushroom cultivation from agricultural residues, becoming aware of conserving natural resources and the environment. They can explain the importance and benefits of conservation to others, such as friends and family.

Chonburi College of Agriculture and Technology

Most students used organic fertilizers instead of chemical ones because they are readily available at the college. However, they may not fully understand the importance of humus in conserving natural resources and the environment. Teachers should organize various activities to encourage students to think about and plan for conservation. Positive reinforcement for well-performing students can motivate others. Additionally, the college should establish a small demonstration plot or learning center as a model for students.

Suphanburi College of Agriculture and Technology

The propagation of ornamental plants was relatively low and short-term. Students' conservation behavior may not be sustainable. Other activities promoting natural resource and environmental conservation, such as using water efficiently and applying bio-fertilizers instead of chemical fertilizers, should be introduced.

Table 5 The method of conserving natural resources and the environment

Action research title	The method of conserving natural resources and the environment			Teaching method		
	Economical use	Reuse	Substitution	Participation	Various activities	Positive reinforcement
1. The agreement of using water in the vegetable production classroom of vocational certificate students, Phetchaburi College of Agriculture and Technology	✓			✓		
2. Organic fertilizer application in soil, water and fertilizer subject of Chonburi College of Agriculture and Technology			✓	✓		
3. Saving water in vegetable production subject of Ratchaburi College of Agriculture and Technology	✓	✓		✓	✓	✓
4. Organic fertilizer application in agriculture principle subject of Ratchaburi College of Agriculture and Technology			✓	✓	✓	
5. Attitudes towards the used agricultural resources in straw mushroom production subject of vocational certificate students, Ratchaburi College of Agriculture and Technology		✓	✓	✓	✓	✓
6. Reuse of plastic bags in the flowering and ornamental plant production subject of vocational certificate students, Suphanburi College of Agriculture and Technology			✓		✓	

From Table 5, the research indicates that volunteer student teachers aim to create awareness among their students about natural resources and the environment through the integration of content into their teaching, the use of various activities, and positive reinforcement. The methods of conserving natural resources and the environment included substitution, economical use, and reuse. From the details of the research results above, it is evident that the problems and methods for conserving natural resources and the environment include economic use, reuse, restoration, rehabilitation, substitution, and prevention of soil and water resource problems. The methods employed by student teachers to raise awareness of natural resource conservation included economic use, reuse, substitution through participatory problem-solving techniques, engaging in a variety of activities, and using positive motivation.

Discussion

Most mentor teachers and student teachers faced soil-related problems at a moderate level (Table 1). One significant issue was the soil's lack of organic matter essential for plant growth due to the sandy conditions of the school's soil. For example, Phetchaburi College of Agriculture and Technology, located in Cha-am District, has very sandy soil with low water-holding capacity, high erosion on slopes, and low fertility (Bureau of Soil Resources Survey and Research Department of Land Development, 2014). Similarly, Ratchaburi College of Agriculture and Technology also has sandy soil with poor water retention (Bureau of Soil Resources Survey and Research Department of Land Development, 2014). Regarding water problems, mentor teachers and student teachers reported moderate issues because the Colleges of Agriculture and Technology have water canals and reservoirs. For instance, Suphanburi College of Agriculture and Technology has access to both tap water and canal water, Chonburi College of Agriculture and Technology uses water from Huai Tu Water Canal, and Phetchaburi College of Agriculture and Technology has reservoirs, though these are sometimes insufficient during the dry season due to external usage.

Most mentors and student teachers had a high level of soil conservation approaches (Table 2). However, three items were rated as moderate: improving the irrigation system, creating windbreaks, and preventing soil pollution through legal measures. Improving the irrigation system is complex and requires expertise (Boonyatharokul, 1983). Creating windbreaks using perennial plants is effective but slow due to the time required for tree growth (Kovanich, 1984). Since agricultural teachers already include soil conservation subjects as models for students, there is less reliance on legal measures to prevent soil pollution (Office of the Vocational Education Commission, Ministry of Education, 2019).

Water conservation guidelines were rated highly (Table 2), with two items rated as moderate: water recycling and treated wastewater. This aligns with Table 1, indicating moderate water shortages in schools. Most educational institutions already have sufficient water supplies from reservoirs and tap water, reducing the need for water recycling and wastewater treatment. The guidelines for the conservation of natural resources and the environment were mostly rated highly, except for one item: creating group activities for resources and environmental conservation. This is because content and activities regarding natural resource conservation are already part of the vocational education curriculum (Office of the Vocational Education Commission, Ministry of Education, 2019).

From Tables 1 and 2, it is evident that the guidelines for conserving natural resources and the environment in educational institutions are rated highly, and the guidelines for raising awareness of conservation are also rated highly. Consequently, problems with natural resources and the environment in educational institutions are at a moderate level. This is because the College of Agriculture and Technology serves as a vocational agricultural learning center that employs practical learning (Siriwan, 2013). Therefore, issues related to natural resources and the environment in these institutions have been addressed to facilitate student learning.

In Table 3, it is shown that the opinions about problems and solutions to natural resources among mentor teachers and student teachers are aligned. This consistency indicates a good opportunity to further develop soil and water resource conservation in schools. To make conservation more sustainable, young teachers and their students should be aware of its importance. The KMITL supervisor emphasized the importance of raising awareness about natural resource conservation. Table 4 outlines the guidelines for instilling awareness among student teachers by incorporating content on conservation into lessons. This approach aligns with recommendations from Meepradit (2016) and Chureegate & Worawan (2016), who advocate for raising awareness of global

citizenship among students through environmental education. Students should learn to appreciate the environment and understand the impact of their actions.

Conserving natural resources and the environment should stem from a willingness and joy to participate in various activities. In this research, only five volunteer student teachers participated. Although the number is small, the results can be extended to many student teachers across various provinces to foster understanding and awareness of conservation. The volunteer student teachers aimed to create awareness by incorporating conservation content following their supervisor's guidelines. This approach is consistent with Meepradit (2016), who emphasized the need for teachers to model good citizenship, responsibility, and public-mindedness. Teachers should also highlight environmental issues, communicate solutions, and encourage student cooperation.

From Table 5, student teacher volunteers conserved natural resources and the environment in schools through substitution, economical use, and reuse. This approach aligns with Rattanalertnusorn (2007), who identified similar methods for conserving nature and the environment, including economical use, reuse, restoration, treatment, substitution, and surveillance. The solutions to soil and water conservation problems outlined in Table 2 include maintaining natural water sources, recycling water, reducing chemical use, and using alternatives to environmentally damaging materials, such as cloth bags instead of plastic bags.

Students' behavior towards natural resource and environmental conservation improved due to the awareness raised by volunteer student teachers. Engaging students in thinking and taking action on conservation through various activities and positive reinforcement was effective. This engagement aligns with constructivist learning approaches, which emphasize hands-on practice and peer collaboration (Na Takuathung, 2002; Intaya, 2010). Using positive reinforcement to maintain desired behavior is consistent with Skinner's theory, which states that positive reinforcement increases the frequency of target behavior (Juliratchaneekorn, 2009; Rafi et al., 2020). The positive reinforcement used by student volunteers included points, compliments, and money.

Suggestions

Recommendations for using this research:

1. The extent of natural resource and environmental problems in schools depends on the teacher. Being a good role model, focusing on natural resources and the environment, and integrating conservation into subjects will foster student awareness and responsible behavior.

2. Raising awareness of natural resource and environmental conservation can be achieved in various ways, depending on the institution's context. Teachers should involve students in expressing their opinions, help them follow agreed guidelines, and allow them to engage in diverse activities. Positive motivation should be created for students, and all personnel in educational institutions should support and reinforce conservation behaviors.

Recommendations for future research:

Increase the number of student teachers involved in conserving natural resources and the environment across all educational levels.

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References:

Boonyatharokul, W. (1983). *Principles of irrigation.* Bangkok: Kasetsart University, Faculty of Engineering, Department of Irrigation Engineering.

Buakamsri, T. (2017). *Natural resources and environment situation in Thailand.* Retrieved May 21, 2022 from http://www.greenpeace.org/seasia/th/news/blog1/2560/blog/60952/

Bureau of Soil Resources Survey and Research Department of Land Development. (2014). *Provincial soil survey report.* Retrieve from http://oss101.ldd.go.th/soilr/product.html

Chureegate, A. and Worawan, S. (2016). *Building awareness to be a good global citizens.* Retrieved November 21, 2022 from http://www.trueplookpanya.com/knowledge/content/50214/-edu-t2s1-t2-t2s2

Juliratchaneekorn, T. (2009). *The effect of verbal prompting techniques and positive reinforcement on coping behaviors of students in secondary education grade 7* (Unpublished Master's thesis). Srinakharinwirot University. Thailand.

Intaya, Y. (2010). *Why is group process important? How do children feel when they study with friends?* Supervisory Education Unit Department of Education, Education District 8. N.P.

Kemmis, S., McTaggart, R., & Retallick, J. (Eds.). (2004). *The Action Research Planner* (2nd ed. rev.). Karachi: Aga Khan University, Institute for Educational Development.

Matiko, M. (1992). *Social Consciousness of Graduate Students at Mahidol University.* Thailand: Charoendee Printing.

Meepradit, K. (2016, December 5). *"Creating Environmental Awareness".* Cultivating environmental awareness. Retrieved from http://www.bangkokbiznews.com/blog/detail/637550

Na Takuathung, O. (2002). *The ultimate development of teaching and learning.* Expernet Books.

Office of the Vocational Education Commission, Ministry of Education. (2019). *Vocational Certificate Program.* Retrieved from https://bsq.vec.go.th/th.

Rafi A., Ansar A., & Sami M.A. (2020). The implication of positive reinforcement strategy in dealing with disruptive behavior in the classroom: A scoping review. *Journal of Rawalpindi Medical College, 24*(2), 173-179.

Rattanalertnusorn, S. (2007). *Principles of conservation and biological management.* Bangkok: Technology Promotion Association (Thai-Japanese).

Sawamechai, R. (2016). The Natural Resources and environmental Management: Soil Resource and Land Use. *The National Defence College of Thailand Journal, 58*(1), 55-75.

Simachaya, W. (2017). *"How can we help preserve water sources?". Water quality and management.* Retrieved July 20, 2022 from www.pcd.go.th/info_serv/water_savewater.html

Siriwan, N. (2013). Future of Thai Agricultural Education, Vocational Agriculture in the Next Decade, ASEAN Community Era. *Journal of Industrial Education, 12*(1), 1-7.

Suwannarat, K. (2015). *Impact of land use on water quality in the Lam Takhong Basin. Nakhon Ratchasima Province. Nakhon Ratchasima Province* (Doctoral thesis). Suranaree University of Technology. Thailand.

Thaipublica (2017). *From piles of plastic waste to garbage patches in the sea: A global crisis that everyone must help solve.* Retrieved March 15, 2022 from https://thaipublica.org/2017/03/waste-in-the-sea/

Kovanich, A. (1984). *Planting trees as windbreaks in Thailand.* Retrieved June 20, 2022 from https://forprod.forest.go.th/forprod/meetingforest/pdf/meeting3/023.pdf

Vachirasirodom, R., Rattanaphan P., Chaisri B., Petcharak, A., & Kittiphongviset S. (2021). Drought conditions and management in the case study area of Phetchaburi Province. *Environmental Journal, 25* (4), 1-7. Retrieved from https://ej.eric.chula.ac.th/article/view/324