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Research Article

Environmental Literacy, Awareness and the Concept of Adaptation to Global Warming of Mahasarakham University Demonstration School (Secondary) Students

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Abstract

This research aims to study environmental literacy, environmental awareness and the concept of adaptation to global warming of students at Mahasarakham University Demonstration School (Secondary) and compare environmental literacy, environmental awareness and concepts that lead to behavioral adaptation to global warming used by Environmental literacy test, Environmental awareness questionnaire and the concept of adaptation to global warming questionnaire. The sample was 100 high school students. The research found that the students had environmental literacy in natural resources and the environment in moderate, literacy of ecology is high. but have a low level of literacy of environmental issues but have a low level of literacy of environmental issues. The students had a high level of environmental awareness of the overall and concepts of adaptation to global warming as a whole of students found that is at a very high level. The knowledge comparison of environmental awareness and the concept of adaptation to global warming of students. It was found that students of different sexes had environmental literacy, environmental awareness, and the concepts of adaptation to global warming as a whole the difference was statistically significant at the .01 level. It can be seen that the management of learning about the environment is important for environmental literacy students environmental awareness and global warming concepts. Therefore, if students want recognize the importance of environmental problems and global warming have a correct understanding by emphasizing the integration of learning management and activities. can be developed environmental literacy, environmental awareness and behavioral changes in adapting to global warming.

Introduction

Currently, the world's population continues to increase at a dramatically accelerated rate in some regions of the world. Although some, some of people who have succeeded in controlling the increase in population, the increase in population, lack of knowledge, understanding and consciousness to properly treat themselves. It causes problems of environmental quality and the decline of natural resources [1]. The environmental problems is very common nowadays and affects the quality of life of human beings. It occurs at the community, Nationally and globally level, The raising awareness, Knowledge, skills, and participation in prevent environmental problems and improve environmental quality. It is necessary to use environmental education because environmental education is an education for people of all ages and all forms of education. Physical, biological, man-made environments, society, culture, economy, politics, religion, interrelated beliefs and values, as well as learning processes and activities, in order to develop people to play a role in preventing environmental problems and improving environmental quality [2].

At present, curriculum and activities related to environmental studies are widely available in the United States, Europe, and other regions. In the United States, The U.S. Senate passed the National Environmental Education Act in 1990, created the U.S. Office of Environmental Studies and organized environmental studies at the national level. Environmental studies are classified as additional courses or electives in schools for kindergarten to secondary school. However, environmental studies are both classroom and out-of-classroom education [2]. The Environment and Development Conference or Earth Summit in Rio de Janeiro, Brazil. in 1992. representatives from various countries, including Thailand, signed the 21 Agenda 21, which is like a global master plan, the essence of which states that education should be integrated in both physical and biological environments and lead to the integration or integration of environmental studies into the curriculum of many countries, until in 2002 the United Nations conference adopted a resolution declaring 2005-2014 as a decade of education for sustainable development, and that integrated education management of environmental studies should be a lifelong learning education [3].According to the report "Deciphering Environmental Studies in Schools from Research", prepared by the Department for The Promotion of Environmental Quality in 2006, it was found that most educational institutions placed a high priority on environmental studies, but qualitatively, they found that there was often a focus on teaching and learning inserted into normal subjects in the classroom, but that teaching and learning in the manner of creating local curricula was minimal. Creating a learning process based on hands-on experience given the environmental situation in the community, there are fewer. This causes students to lack connections to the learning process and lifestyle, and organizing the learning process to reflect the success of the educational environment must lead to educating. Raising awareness, learning from direct experience, and taking action for long-term behavior modification [4].

Therefore, in the construct of the environment knowledge, awareness and adaptation people's behavior towards global warming to make people coexist with the environment in a balanced manner, it's will require an educational management system and environmental education methods, which manage environmental learning in the core basic curriculum of Thailand education inserted environmentally related material into the learning materials of various subject groups with no specific environmental subjects resulting in students do not see the importance of the environment as much as it should be, lack of awareness, and the resulting evaluation measures do not reflect of knowledge, awareness and change in environmental behavior. Therefore, we were interested in analyzing core basic curriculum in Thailand education, which is used as a teaching and learning curriculum for secondary school students at Mahasarakham University Demonstration School (Secondary). What courses are inserted in the contents related to the environment? How the learning about the environment in various subjects affects to students environmental knowledge, awareness and conceptualizing adaptation behaviors for the environment and global warming issues?.

Method

Population and Sample

i. The population were 1770 students of Mahasarakham University Demonstration School (Secondary)
ii. The sample were 100 students of Mahasarakham University Demonstration School (Secondary) collected by random sampling.

Instruments of Research

i. Environmental literacy test
ii. Environmental awareness questionnaire
iii. Concept of adaptation to global warming questionnaire

Construct and Instruments Quality

a. Create a knowledge Environmental literacy test, 50 items, check content validity, Index of Item-Objective Congruence (IOC) by experts The test was conducted (try out) with 30 non-sample students to determine the difficulty and power of discrimination. Then select a quality test of 20 items, consisted knowledge about natural resources and environment, 8 items, knowledge about ecology, 6 items, and knowledge about environmental issues, 6 item and tested the reliability of the test with the KR-20 formula, found that the test confidence was 0.75.
b. Create an environmental awareness and global warming questionnaire. The correctness of The questionnaire was examined for content validity, Index of Item-Objective Congruence (IOC) by experts and selecting items with an IOC value of 0.50 or higher. The item-total correlation power of the questionnaire was determined by the formula for the alpha coefficient (α-Cronbach Coefficient), the questionnaire must have a confidence value of .80 or higher to be able to be used. Which found that the questionnaire has a confidence value of 0.88
c. Create a Concept of adaptation to global warming questionnaire. The correctness of The questionnaire was examined for content validity, Index of Item-Objective Congruence (IOC) by experts and selecting items with an IOC value of 0.50 or higher. The item-total correlation power of the questionnaire was determined by the formula for the alpha coefficient (α -Cronbach Coefficient), the questionnaire must have a confidence value of .80 or higher to be able to be used. Which found that the questionnaire has a confidence value of 0.89

Data collected

Phase 1

- Coordinate and invite 5 professors in science, social science and environmental studies to be experts
- Study and analyze indicator standards in school curriculum related to the environment in the upper secondary level of Mahasarakham University Demonstration School (Secondary)
- Create a knowledge Environmental literacy, environmental awareness and global warming questionnaire and Concept of adaptation to global warming questionnaire and improved, and analyzed the quality of research instruments.

Phase 2

- Create campaign activities to promote environmental knowledge and publicizing knowledge about the conditions of global warming to stimulate interest in high school students.
- Conduct an environmental knowledge test on a sample group of students.
- Use a questionnaire to measure environmental awareness and global warming.
- The questionnaire measures concepts of adaptation and behavior change against global warming

Data Analysis

i. The analyze percentage and the mean value of the environmental literacy test and the concept of adaptation to global warming by using the interpretation criteria as follows:

Table 1: Showed the criteria for interpreting the level of environmental knowledge and the concept of adaptation to global warming.

Percentage	Literacy Level	concept of adaptation Level
More than 79	Very high	Very high
70-79	High	High
60-69	Moderate	Moderate
50-59	Low	Low
Lower 50	Very low	Very low

ii. Analyze and describe the data using environmental awareness questionnaire, the following interpretation criteria: [5]

Scor level	Awareness Level
4.50-5.00	Very high
3.50-4.49	High
2.50-3.49	Moderate
1.50-2.49	Low
1.00-1.49	Very low

iii. Analyze and describe the data using the concept of adaptation to global warming questionnaire, the following interpretation criteria : [5]

Scor level	concept of adaptation Level
4.50-5.00	Very high
3.50-4.49	High
2.50-3.49	Moderate
1.50-2.49	Low
1.00-1.49	Very low

Statistics used to analyze data

A. Basic Statistics
a. Percentage
b. Mean
c. Standard deviation
B. Statistics for Instruments quality
a. Item-Objective Congruence (IOC)
b. The difficulty and discrimination for the environmental literacy test.
c. The discrimination for the questionnaire used Item-total correlation
d. The reliability of the test with the KR-20 for the environmental literacy test.

C. Statistics for the Hypothesis test
a. The Mean Comparison Statistics used an independent t-test
b. Statistics to check the correlation coefficient (Simple Correlation) of Pearson

Result and Discussion

Result

An analysis of the Basic Core Curriculum Education, 2008 used as a curriculum for teaching and learning at the secondary level in Thailand with learning content related to the environment found that there were 3 learning subject groups, including science subjects group, Social Religion and Culture Learning Subject group and the matter of occupation and technology subject group which are as follows:

science subjects group

Substance 1 Living things and life processes Learning Standard V 1.2 : Understand the process and importance of genetic inheritance in the evolution of organisms and biodiversity. The use of biotechnology affects humans and the environment, there is a process of seeking knowledge and psychology Communicate what has been learned and put knowledge to good use.

Substance 2 Life with Environment Learning Standard V 2. 1 : Understand the local environment The relationship between the environment and living things Relationships between living things in an ecosystem. There is a process of seeking knowledge and a scientific mind. Communicate what has been learned and put knowledge to good use.

Learning Standard V 2. 2 : Understand the importance of natural resources Use of natural resources at local, national and global levels. Apply knowledge to manage natural resources and the local environment sustainably.

Substance 5 Energy Learning Standard V 5.1 : Understand the relationship between energy and livelihoods. Transformation Energy Interaction between matter and energy The effect of energy consumption on life and the environment There is a process of searching for knowledge. Communicate what has been learned and put knowledge to good use. Substance 8 Natural Science and Technology Learning Standard V 8.1: Use the scientific process and scientific mind to search for knowledge, solve problems, know that most natural phenomena that occur have definite patterns. Able to explain and verify information and tools available at that time Understand that science, technology, society and the environment are interrelated.

Social Religion and Culture Learning Subject group

Substance 3 Economics Learning Standard S 3.1: Understand and manage resources in production and consumption, use of limited resources efficiently and cost-effectively including understanding the principles of a sufficiency economy for a balanced life.

Learning Standard S 3.2: Understand various economic systems and institutions, economic relations and the need for economic cooperation in the global society.

Strand 5 Geography Learning Standard S 5.1: Understand the nature of the physical world and the relations of things that affect each other in the system of nature use maps and geographic tools to efficiently search, analyze, summarize, and use geospatial data.

Learning Standard S 5.1: Understand the interactions between humans and the physical environment that contribute to the creation of culture, be conscious, and participate in resource and environmental conservation and sustainable development.

Matter of occupation and technology subject group

Strand 1 Life and family Learning Standard G 1.1 : understand the work be creative have work process skills, management skills problem solving skills, collaboration skills and knowledge seeking skills, the having morals and working habits, be conscious in using energy, resources and environment for life and family

Substance 2 Design and Technology Learning Standard G 2.1 : understand technology and technology processes Creatively design and construct materials, appliances or methods according to the technological process. Choose to use technology in a creative way for social life, the environment, and participate in sustainable technology management.

Therefore, it can be seen that in teaching and learning at the high school level There are no direct environmental courses. There is only content in some subjects. Make students at the secondary level, which is an important group of youth lack of understanding of environmental problems problem of global warming.

Table 2: Scores, Mean, Standard deviation, and Percentage of environmental knowledge level of students. Categorized individually and overall.

Environmental literacy	Score	$\bar{X}$	S.D.	%	Level
1) National resource and environment	8	5.2	1.01	65	Moderate
2) Ecology	6	5.1	1.32	85.3	Very high
3) Environmental problem issue	6	3.5	1.21	58.3	Low
Overall	20	13.8	4.24	69	Moderate

Table 3: Mean, standard deviation, environmental awareness level of students classified by aspect.

Environmental awareness	$\bar{X}$	S.D.	Level
1) Ecosystem	4.19	0.55	High
2) National resource	4.31	0.55	High
3) Environmental problem issue	4.25	0.51	High
Overall	4.25	0.51	High

The result Table 3, it was found that students are aware of the overall environment and on all aspect high level.

The comparison Environmental literacy, environmental awareness and the concept of adaptation to global warming Students.

Table 4: The results of the comparison of the mean Environmental literacy of students with different gender Classified by aspect.

Environmental literacy	gender	n	$\bar{X}$	S.D.	t	Sig.
1) National resource and environment	Male	35	3.1	2.03	-3.35	0.00**
	Female	65	3.65	1.81		
2) Ecosystem	Male	35	4.35	1.27	-3.03	0.00**
	Female	65	4.68	1.34		
3) Environmental problem issue	Male	35	3.17	1.84	-4.5	0.00**
	Female	65	3.84	1.58		
Overall	Male	35	10.62	4.18	-4.53	0.00**
	Female	65	12.17	3.83		

**Sig. < .01

The result Table 4, it was found that students of different gender had environmental literacy both in aspect and overall was statistically difference significant at the .01 level, with female students having higher environmental literacy than males.

Table 5: The comparison of the mean Environmental awareness of the students with different genders classified by aspect.

Environmental awareness	Gender	n	$\bar{X}$	S.D.	t	Sig.
1) Ecosystem	Male	35	4.11	0.51	-2.86	0.00**
	Female	65	4.24	0.57		
2) National resource and environment	Male	35	4.24	0.49	-2.49	0.02*
	Female	65	4.35	0.58		
3) Environmental problem issue	Male	35	4.17	0.45	-2.92	0.00**
	Female	65	4.29	0.54		
Overall	Male	35	4.17	0.45	-2.92	0.00**
	Female	65	4.29	0.54		

**Sig. < .01 และ *Sig. < .05

The result Table 5, it was found that the different genders students, there're environmental awareness, Environmental problem issue and overall are statistic significantly different at the .01 level. The difference was statistically significant at the .05 level in both overall and individual aspects. The female students had higher environmental awareness than males.

Table 6: The correlation coefficients between Environmental literacy, Environmental awareness and Concept of adapting to global warming of students.

Variable	Environmental literacy	Concept of adapting to global warming	Environmental awareness
Environmental literacy	1	0.63**	0.39**
Concept of adapting to global warming		1	0.51**
Environmental awareness			1

Sig. < .01

The result Table 6, it was found Environmental literacy, Environmental awareness and Concept of adapting to global warming had a statistically significant positive correlation at the .01 level with a correlation coefficient (r) Environmental literacy with Concept of adapting to global warming was 0.63, between Environmental literacy with Environmental awareness was 0.39, and between Concept of adapting to global warming with Environmental awareness was 0.51.

Discussion

The Basic Core Curriculum Education 2008 of Thailand used as a curriculum for teaching and learning at the high school level with learning content related to the environment, it was found that there were 3 main learning subject groups with standards for subjects that include environmental content issues for students, including science subjects group, Social, Religion and Culture Subject Group and matter of occupation and technology subject group from the analysis of learning in the curriculum It can be seen that in teaching and learning at the high school level there are no direct environmental courses. There is only content inserted in some parts of the course which has been inserted a lot in science subjects similar in many countries [6].The environmental education curriculum is included in the science curriculum in countries such as Turkey, Australia, Singapore, Ireland and Canada, but the environmental education curriculum is not directly organized in Thailand it, affect to high school students, which is an important group of youth lack of understanding of environmental problems problem of global warming The fact that environmental issues are not included in the coursework causes students to lose attention in terms of the environment Looking at the impact on the environment is far away, Therefor in order to instill knowledge in youth environmental awareness There must be activities or encouragement to promote knowledge continuously. Hye-Eun Chu [7] proposed that awareness and learning of the environment for children or students most often. It's developed as an integrated learning curriculum especially in the course ecology Science, So in development children's environmental knowledge. The parents should play a role in their children's environmental education program. Because the behavior of parents will be a model for the development of children's behavior. Therefore, the development of environmental knowledge begins from childhood. It is important to Help children develop appropriate knowledge and attitudes about environmental preservation. thus making students aware of environmental problems and the problem of global warming This will be an important basis to lead to adaptation or change in behavior. respond well to global warming in the future.

The measure environmental literacy was found that the students had knowledge about the environment in terms of ecology as much as possible followed by natural resources because it is the content that is inserted in the science subjects at the lower secondary level and biology subjects at the high school level but with regard to environmental issues related to global warming. This may be due to the low level of knowledge of students in the curriculum taught at the basic education level. There are no specific lessons on environmental issues. But it is inserted in only some of the subjects [8]. The integrated learning for environmental literacy is built using the PBL model as the core of the learning process. and supplemented with environmental knowledge textbooks and KITs with environmental knowledge indicators (environmental knowledge identification of issues analysis of issues In addition, integrated learning taught in the experimental class improved the level of knowledge of the students' environmental knowledge compared to the control class. Most of the students scored the highest in their knowledge of ecology. and second is the general feeling of the environment. while the lowest score was on identifying and analyzing issues. Muchtar Haryanto, Panjaitan Nurfina, Aznam Pujianto, Nedia Erlini, Aza AyuDin Illahaqi [9] understanding of students' environmental knowledge in learning science 71.9% of students agreed that environmental literacy was very necessary, meaning that they had a strong understanding of the importance of environmental literacy. but still lacking implementation because from the information there are still some students who have not received environmental learning Improving students' environmental knowledge skills is essential to developing their potential and can motivate them to solve environmental problems. Therefore, it is advisable to adopt integrated learning to develop environmental knowledge and it is better to apply environmental knowledge to different subject educational practices. The results showed that integrated learning in environmental knowledge had a positive effect on students' understanding of all environmental knowledge. In addition, the statistical analysis showed a significant value of 0.000 ($p< 0.05$). This result indicates that environmental knowledge integrated learning can improve students' environmental knowledge. Gwyneth Moody, Huda Alkaff, Dawn Garrison, and Frank Golle [10] the need to assess environmental knowledge of The University of Georgia(UGA) requires that all undergraduate students knowledge of the environment. Their results show that students are enthusiastic about ELRs and find that they are more willing to learn about the environment.

ELRs are helpful. The ELR was broad and accepted, but lacked coordination. UGA's educational experience will be invaluable to other institutions contemplating broader environmental needs unfortunately, the overall understanding of the human environment and its interaction with the environment is inadequate, i.e. the number of people in maintaining the health, productivity, and sustainability of nature is decreasing. This understanding must build knowledge of the natural and physical sciences, social sciences, and related subjects in the humanities and arts. The teachers need to be prepared to know about the environment including teachers have to learn about the environment. from additional media. Akkaya Yılmaz, M [11] the studied the level of environmental knowledge of social studies teacher applicants it was found that the teacher applicants had moderate knowledge of the environment. and the level of environmental knowledge did not differ by class and gender. Social studies teacher candidates often define environmental literacy by providing information on heritage topics. In addition, teacher candidates say they use resources such as articles, books and magazines to develop their environmental literacy skills. They said they faced many difficulties in upgrading environmental knowledge due to the impact of education, family and society.

The Environmental literacy, environmental awareness and the concept of adaptation to global warming of Mahasarakham University Demonstration School students (Secondary) had a statistically significant positive relationship at the .01 level. Sara Pe'er, Daphne Goldman, and Bela Yavetz [12] found that the relationship between environmental attitudes and knowledge of 765 students in three teacher training colleges in Israel was found is a positive relationship between knowledge with environmental attitudes and background factors and their relationship to environmental behavior. it's in a positive way although the students' knowledge of the environment was limited by the overall attitude of the environment. The students understood the effects of global warming on living organisms. daily life and Climate change resulting from global warming very high level. The concept of adapting to global warming and changing behavior that helps reduce global warming. at a high level and knowledge, awareness of the environment and adaptation to global warming of students there was a statistically significant positive correlation. It's shows that management of teaching and

learning activities related to the environment cause the development of knowledge and understanding of the environment and global warming of students to increase especially in learning management and integrating activities in teaching and learning in science subjects. As in the research study Science Education for Environmental Awareness: an integrated cognitive and spiritual approach [13]. The science education plays an important role in understanding the evolution from the underlying concepts of potential environmental problems to behaviors that initiate with the environment. The supporting the development of students in a positive attitude towards the environment will help them to aware of the environmental alternative crisis it's essential for taking care of the environment. The learning and adapting to Climate Change It is a necessity in the future. Kashif Abbass,Muhammad Zeeshan Qasim, Huaming Song, Muntasir Murshed, Haider Mahmood, Ijaz Younis [14] studied the effects of global climate change, adaptation and sustainable mitigation measures, and found that climate change is a long-lasting change in climate across the tropics. It is a global threat that causes concern to various sectors especially agricultural sector, and relevant all over the world because due to insufficient production and food supplies are threatened from irreversible fluctuations in climate, on the other hand, it is challenging global food production. Especially in countries where agriculture is an important part of the economy. The Climate change also puts the health and survival of many species at risk due to variations in the optimum temperature range. There by accelerating the loss of biodiversity by continuously changing the ecosystem structure climate variability increases the probability of disease and disease carriers increased the latest example is the COVID-19 pandemic.

Therefor, Environmental literacy, Environmental awareness and adaptation to global warming it's necessary for students learning to gain knowledge and understanding about environmental problems, understanding impact on the world, Community, and yourself, in order to be able to adapt to change and can live in balance with the environmental ecology, as well as conducting oneself as a good citizen Contribute to environmental conservation prevent environmental problems including transferring knowledge and awareness to other people or youth of the next generation.

Conclusion

The analysis of the Basic Core Curriculum Education 2008 with learning content related to the environment, it was found that there were 3 main learning subject groups with standards for subjects that include environmental content issues for students, including science subjects group, Social, Religion and Culture Learning Subject Group and the matter of occupation and technology subject group.

The study Environmental literacy, Environmental awareness and Concept of adapting to global warming it was found that the Mahasarakham University Demonstration School (Secondary) students had moderate of environmental literacy in terms of natural resources and the environmental problem issue. Theirs're had a high level of knowledge in ecology but have a low level of environmental issues, high level of overall of Environmental awareness and concepts of adaptation to global warming as a whole of students found that is at a very high level. The Environmental literacy with Environmental awareness knowledge comparison of genders different found that as a whole difference was statistically significant at the .01 level.

The Environmental literacy, environmental awareness and the concept of adaptation to global warming of Mahasarakham University Demonstration School students (Secondary) had a statistically significant positive relationship at the .01 level.

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