Model of Ecosystem and Environmental Conservation Behavior of Junior High School Students

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Abstract

This research was conducted to develop the model of the ecosystem and environmental conservation behavior of junior high school students. It employed a questionnaire for data collection from 400 junior high school students in the Secondary Educational Service Area Office 19 (Nongbua Lamphu) during the second semester of the 2013 academic year. Research results demonstrated that Inspiration of the Public Mind (PUB) was the most important variable, accounting for 0.78 of variation in ecological and environmental conservation behavior, while environmental education and ecological system and environmental knowledge were the second and third influential variables at 0.29 and 0.27 respectively.

Keywords: Model, Ecosystem , Environmental conservation , Environmental education, Inspiration of public mind.

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แบบจำลองพฤติกรรมการอนุรักษ์ระบบนิเวศและสิ่งแวดล้อมของนักเรียนมัธยมศึกษาตอนต้น

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บทคัดย่อ

การวิจัยเพื่อพัฒนาจำลองในพฤติกรรมการอนุรักษ์ระบบนิเวศและสิ่งแวดล้อมของนักเรียนมัธยมตอนต้น ใช้แบบสอบถามเป็นเครื่องในการสำรวจ สำหรับเก็บข้อมูลจากกลุ่มตัวอย่าง 400 คน ในสังกัดสำนักงานเขตพื้นที่การศึกษามัธยมศึกษาหนองบัวลำภู เขต19 ในปีการศึกษา 2556 ภาคเรียนที่ 2 ผลการวิจัยพบว่า โดยแรงบันดาลใจในการมีจิตสาธารณะมีอิทธิพลสูงสุดต่อพฤติกรรมการอนุรักษ์ระบบนิเวศและสิ่งแวดล้อม ของนักเรียนระดับมัธยมศึกษาตอนต้น เท่ากับ 0.78 รองลงมาเป็นสิ่งแวดล้อมศึกษาและความรู้การอนุรักษ์ระบบนิเวศและสิ่งแวดล้อมมีอิทธิพลเท่ากับ 0.29 และ 0.27 ตามลำดับ

คำสำคัญ: แบบจำลอง, ระบบนิเวศ การอนุรักษ์สิ่งแวดล้อม, สิ่งแวดล้อมศึกษา, แรงบันดาลใจในการมีจิตสาธารณะ

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Introduction

An ecological system or ecosystem is a system of interaction and interdependence among living organisms of animals, plants, and microbes and the nonliving components of their environment, including air, water, soil, and mineral substances whilst these link together through nutrient cycles and energy flows (Molles, 1999; Gurevitch et al., 2006; Smith & Smith 2012). Their sizes usually encompass specific and limited spaces (Chapin et al., 2002) even though some scientists declare that the whole planet is an ecosystem (Chapin et al., 2002; Krebs, 2009; Willis, 1997). Therefore, "it is a community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships and including such processes as the flow of energy through trophic levels and the cycling of chemical elements and compounds through living and nonliving components of the system" (The American Heritage® Science Dictionary, 2002), whilst natural environment covers all living and non-living things naturally occurring on earth and any region of the world and includes the interaction of all living species and its environment of climate, weather, and natural resources involving human survival and economic activity. However, the natural environment notion can be distinguished by two components: 1) Whole ecological units work as natural systems, regardless of different cultured human contribution, together with all flora, fauna, microorganisms, soil, rocks, atmosphere, and natural events happening within their borders and 2) Universal natural resources and physical occurrences are lacking in particular restrictions, such as air, water, and climate, plus energy, radiation, electric charge, and magnetism, not deriving from cultured human activity (Thiengkamol. 2009c; Wikipedia, 2014).

Taking into consideration the ecological conservation explanation, it is the procedure of the natural environment preservation for upcoming generations; however, it can be used in a sustainable way to take full advantage of yield exclusive of the ecological and environmental destruction (Solomon et al., 2004). Therefore, it might engage a variety of types of conservation goals in cooperation with those intended with regard to the security of soil, rivers, trees, and atmospheric quality. The regulation of ecological conservation programs can be controlled by law. Requiring the people to take responsibility for protecting the planet, law enforcement must encourage business-men to take care of the environment. Education is the most significant aim of ecological conservation. In particular, the way of sustainable living is the means to conserve the ecosystem (Saisunantharom et al., 2013a; Suebsing et al, 2013b). Derived from the diverse studies, it was indicated that environmental education is the most excellent method to guide real behavioral change. Consequently, at the heart of ecological and environmental conservation is sustainable living (Chomputawat et al., 2013a; Thiengkamol, 2011b).

The sustainable development concept is congruent with the environmental education principle in developing sustainable systems and processes for ecological and environmental conservation. The sustainable development includes four interconnected pillars: ecology, economics, politics, and culture. Sustainability has emerged as an essential effect, including worries about the unplanned social, environmental, and economic consequences of quick population growth, economic development, and natural resource utilization. In addition, sustainability can be distinguished in terms of materials and technical choices for supplying the present needs of people without compromising the survival of future generations. Stable agricultural strategies must put emphasis on allocation to foster the present population and to guarantee future generations with sufficient food. The strategies must focus on preventing the populace from causing a species to become extinct or slaughtering any endangered species for business or sport; therefore, it must be promptly implemented (Solomon et al., 2004; Thiengkamol, 2011a). Nevertheless, ecological conservation also involves soil, air, and water conservation, alongside the preservation of wildlife habitats and strange beauty. Controlling air and water pollution maintains environmental quality. Additional implementation, in particular education, should be broadly given for water conservation to supply the demands for safe drinking water (Solomon et al., 2004; Vold, and Buffett, 2008). On the other hand, ecological conservation also concerns the ozone layer, prohibiting numerous ozone depleting substances. Therefore, investments have been made to search for more sustainable options. Sustainability is critical in guaranteeing the preservation of water, materials, and resources to sustain human health and environmental quality (Saisunantharom et al., 2013; Thiengkamol, 2011).

The inspiration of the public mind for environmental conservation was another significant latent variable that was introduced in this study since Thiengkamol (Thiengkamol, 2012) and her colleagues have confirmed this hypotheses in several studies (Udonboon et al., 2012; Saisunantharom et al., 2013). This latent variable consists of role-model impressions, accompanied with impressions of the environment, events, and media awareness along with a self-public mind. The significance of a public mind for natural resources and environmental conservation, soil conservation, and water conservation behaviors, including environmental knowledge of transferring and supporting behaviors, was observed as variables to predict this latent variable. The inspiration is completely different from motivation because one who acts with regard to environmental conservation should do so with the drive gained from an inspired demand (Thiengkamol, 2011a; Thiengkamol, 2011b). Therefore, one who has the

inspiration of a public mind should be cheerful in doing so, supporting environmental conservation without wanting any rewards, including money, honor, or admiration. The inspiration for such an act may have been attained from a role model, an impressive environment, an impressive event, and/or inspiration from perception of the media (Chomputawat et al., 2013; Saisunantharom et al., 2013; Suebsing et al, 2013).

In this study, the ecological and environmental conservation behaviors given attention were soil conservation, water conservation behavior, forest conservation behavior, ecosystem conservation behavior, and knowledge-transferring behavior since these conservation behaviors would be able to direct the lower secondary school students to appreciate and comprehend the necessary elements to meet sustainable development. Moreover, the families of the majority of the lower secondary school students in Nongbua Lamphu Province in the Northeastern region of Thailand are in the agricultural sectors involved with the diverse actions of farming. However, the majority of them cultivate rice, vegetables, and fruit for household eating, and some of this food is sold to the marketplace. Consequently, if the lower secondary school students were taught to recognize and appreciate the association between the ecosystem, the environment, and themselves, it would inspire and motivate them to take serious action for ecological and environmental conservation so that sustainable development could be attained.

Research Objective

The objective of this research was to develop the model of factors affecting the ecological and environmental conservation behavior of junior high school students.

Research Methodology

The research method was conducted step by step as follows:

1) Population and Sample

The population was 15,560 junior high school students from schools under the Secondary Educational Service Area Office 19 (Nongbua Lamphu) during the second semester of the 2013 academic year. The survey research was conducted by sample collection using Multi-Stage Random Sampling to collect data from 402 students. The research instrument was the questionnaire for data collection.

2) Research Tool

The content and structural validity of the questionnaire was proved by the Item Objective Congruent (IOC) from 5 experts in the fields of ecology, environmental education, social science, and social research methodology. The questionnaire was composed of 154 items with 5 rating scales and was used as a research instrument to collect the data. The reliability was tested by comparing a sample group from 40 lower secondary school students who had the same characteristics with a sample group from an adjacent province. The reliability was

determined by Cronbach's Alpha formula. The ecological and environmental knowledge (EEK) was composed of 39 items; environmental education (EE) was composed of 46 items; inspiration of a public mind (PUB) was composed of 28 items; and ecological and environmental conservation behavior (BEH) was composed of 41 items. Their reliabilities were 0.93, 0.964, 0.953, 0.965 and 0.977 respectively.

3) Data Collection

The Multi-Stage Random Sampling technique was employed for the data collection from 402 lower secondary school students under the Secondary Educational Service Area Office 19 (Nongbua Lamphu) in the Northeastern region of Thailand. The research instrument was the questionnaire, and it was used for data gathering.

4) Data Analysis

The descriptive statistics were frequency, percentage, mean, and standard deviation. The Structural Equation Model (SEM) was used for model confirmation with the LISREL version 8.30, considering whether the Chi-Square value had a statistically significant level of 0.01 or a Chi-Square/df value of less or equal to 5, RMSEA (Root Mean Square Error Approximation) and RMR (Root Mean Square Residual) values with less than 0.05, including an index level of model congruent value, GFI (Goodness of Fit Index) and an index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.9-1.00.

Results

The Ecological and Environmental Knowledge (EEK) and the Inspiration of a Public Mind (PUB) had effects on the Ecological and Environmental Conservation Behavior (BEH) as follows:

1) Confirmatory factors of the EEK Directly affected the PUB with a statistically significant level of 0.01 with an effect of 0.16, and EEK directly affected the BEH with a statistically significant level of 0.01, with an effect of 0.27, and indirectly affected the BEH with a statistically significant level of 0.05, with an effect of 0.13.

2) Confirmatory factors of the EE directly affected the PUB with a statistically significant level of 0.01, with an effect of 0.78, and the EE directly affected the BEH with a statistically significant level of 0.01, with an effect 0.29, and indirectly affected the BEH with a statistically significant level of 0.05, with an effect of 0.61.

3) Confirmatory factors of the PUB directly affected the BEH with a statistically significant level of 0.01, with an effect of 0.78.

4) Considering the structural model of the confirmatory factors, the EEK, EE, and the PUB affected the BEH with effects of 95.00 percent. The structural equation can be written as shown in Equation (1).

$$BEH = 0.78*PUB+0.27*EEK+0.29*EE \quad \text{.....(1)}$$

$$R^2 = 0.95$$

In Equation (1), the factor that had the most effect on the BEH was the PUB, with an effect of 0.78, subsequent were the EE and the EEK with effects of 0.29 and

0.27 respectively, providing an explanation for the variation of the BEH with 95.00 percent.

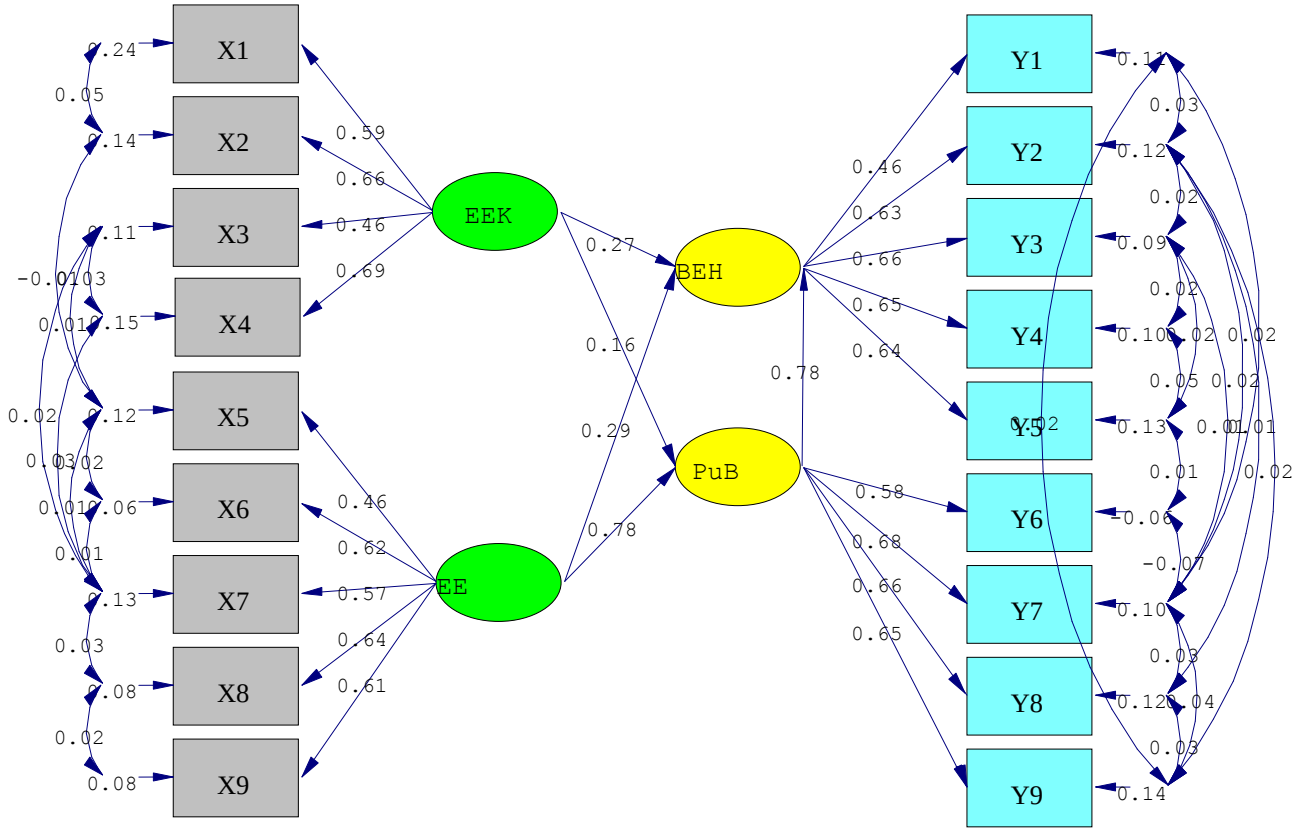
5) Considering the confirmatory factor of the PUB of lower secondary school students, it demonstrated that the EE had an effect on the PUB of 0.78, and the EEK had an effect on the PUB of 0.16. These provide an explanation for the variation of the PUB with 79.00 percent. The structural equation can be written as demonstrated in Equation (1).

PUB = 0.16*EEK+0.78*EE .....(1)

R^2 = 0.79

In Equation (1), the factor that had the most effect to the PUB was EE, with an effect of 0.78, subsequent was EEK with an effect of 0.16, providing an explanation for the variation of the Inspiration of a Public Mind (PUB) with 79.00 percent.

The results of exogenous variables had an effect on endogenous variables, with direct and indirect effects illustrated in Figure 1 and Table 1.



Chi-Square=188.30, df=98, P-value=0.00000, RMSEA=0.044

Figure 1: Model of Direct and Indirect Effect of EEK and EEC Affecting BEH via PUB

Table 1 Direct and Indirect Effect of EEK and EEC Affecting BEH via PUB

Causal variable	Result variables					
	PUB			BEH		
	TE	IE	DE	TE	IE	DE
EEK	0.16* (0.059)	-	0.16* (0.059)	0.40** (0.045	0.13* (0.045)	0.27** (0.041)
EE	0.78** (0.13)	-	0.78** (0.13)	0.90** (0.055)	0.61** (0.065	0.29** (0.045)
PUB	-	-	-	0.78** (0.026)	-	0.78** (0.026)
χ^2 = 188.30; df = 98			CN = 332.07		χ^2 / df = 1.921	
GFI = 0.96;		AGFI = 0.93	RMSEA = 0.044		RMR = 0.0083	

Discussion

The findings indicated that understanding the concept of Ecological and Environmental Knowledge (EEK) was predicted by the four observed variables of Ecosystem Conservation (X4), Water Conservation (X2), Forest Conservation (X3), and Soil Conservation (X1) with predicting powers of 0.81, 0.73, 0.71, and 0.62 respectively. It is obviously seen that Ecosystem Conservation (X4) was the highest power prediction; therefore, it might point out that lower secondary school students realize and are aware of the significance of the ecosystem. Consequently, the school administrators should integrate it into the teaching-learning process for all subjects concerning science and nature. In addition, they need to advise the teachers to continuously apply this knowledge in the other various subjects. This should aid the lower secondary school students in speedily changing their attitude and raising awareness.

Consequently, the students are able to effectively give their knowledge and understanding of the ecological system and of the environment to their families and communities. Furthermore, the other 3 observed variables of Water Conservation (X2), Forest Conservation (X3), and Soil Conservation (X1) also had rather high prediction powers for forecasting the latent variable of the EEK whilst the EEK demonstrated with the total effect on Ecological and Environmental Conservation Behavior (BEH) with an effect of 0.40, thus these 3 observed variables can also be used to integrate into all scientific subjects as well. Therefore, it is obviously seen that this latent variable (EEK) plays a vital role to modify the latent variable of the Ecological and Environmental Conservation Behaviors (BEH).

Simultaneously, considering another exogenous latent variable, the EE had a total effect on BEH of 0.90. It pointed out that the EE has a very high effect on BEH in

this model and is a very important exogenous latent variable, altering the BEH of the lower secondary school students. Moreover, the EE was predicted by the 5 observed variables of Environmental Knowledge and Understanding (X5), Environmental Awareness (X6), Environmental Attitude (X7), Environmental Participation (X8), and Environmental Responsibility (X9) with prediction powers of 0.59, 0.88, 0.75, 0.82, and 0.80 respectively. As a result, if the school directors integrated the EE with the EEK in the teaching-learning process, it would rapidly accelerate the pro-environmental behavior of students.

Confirming the endogenous latent variables of the BEH, it was predicted by Forest Conservation Behavior (Y3), Ecosystem Conservation Behavior (Y4), Environmental Knowledge Transferring Behavior (Y5), Water Conservation Behavior (Y2), and Soil Conservation Behavior (Y1) with prediction powers of 0.89, 0.82, 0.80, 0.75, and 0.65 respectively. It implied that lower secondary school students understand and realize the significance of these factors. The teacher can use the five observed factors to challenge the student to change their behaviors of soil, water, forest, and ecosystem and environmental knowledge, helping them to transfer it effectively. For a successful outcome with regard to ecological and environmental conservation, the EEK and the EE must be incorporated into all types of the teaching-learning process for lower secondary school students by inspiring them to act as important change agents to transfer their ecological and environmental knowledge and environmental education to those people within their influence, such as friends, family members, and other people in the community and society by expressing their capabilities of soil, water, forest, and ecosystem conservation with inspiration of a public mind for environmental conservation in terms of being a good role model, having a self-public mind, and distributing the environmental information to everyone seriously. The results were congruent with Thiengkamol and her colleagues (Chomputawat et al., 2013; Saisunantharom et al., 2013; Suebsing et al., 2013; Thiengkamol, 2011; Thiengkamol, 2012; Udonboon et al., 2012).

Besides the mentioned latent variables of the EEK, EE, and the BEH, the results also showed that the Inspiration of a Public Mind (PUB) directly affected the BEH with an effect of 0.78 whilst the 4 observed variables of the Event Impression (Y7), Environment Impression (Y8), Impression from Various Media Reception (Y9), and Role Model Impression (Y6) were able to predict the BEH with effects of 0.69, 0.84, 0.82, 0.79, and 0.69 respectively. These were pertinent with respect to the abundant studies of Thiengkamol and her colleagues (Chomputawat et al., 2013; Saisunantharom et al., 2013; Suebsing et al., 2013; Udonboon et al., 2012).

Suggestions

Thus, these research results are able to be integrated into the national education policy and plan of the Ministry of Education at the lower secondary school level. Inspiration and challenge can be provided for the junior high school students so they can exhibit a better ecological and environmental conservation behavior. Therefore, administrators of junior high schools should introduce activities for junior high school students via field trips in order to make the students realize the importance of ecological balance and environmental conservation. This can successfully promote and support ecological and environmental conservation. However, the junior high school students are our next generation and must take responsibility to be important change agents as environmental educators or trainers to spread their knowledge of the ecosystem and of the environment with a public mind, devoting themselves to community and society.

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