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A Study of Fifth Graders' Environmental Learning Outcomes in Taipei

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Abstract

Environmental education has recently received much more attention than before among elementary school students' science learning in Taiwan. The major purpose of this study is to explore the learning outcomes on environmental education for 5th graders in Taipei. A quasi-experimental design with a single group was used in this study. Students in the experimental group (N=24) undertook five weeks of environmental education activities and a field trip to Elephant Mountain in rural Taipei. Three research instruments were used in this study, including an environmental education achievement test, an attitude toward environmental education scale, and an attitude toward environmental action skills. The results were analyzed using a *t-test*. The results of this study include: (1) the results of the environmental education achievement test showed that in the post-test the students obtained higher scores than in the pre-test ($t = 7.47$, $p < .001$); (2) the results of the attitude toward environmental education scale showed that students in the post-test achieved higher scores than in the pre-test ($t = 4.10$, $p < .001$), and (3) in the attitude toward environmental action skills students in the post-test achieved higher scores than in the pre-test ($t = 3.63$, $p < .01$). Therefore, it can be concluded that environmental education activities and the field trip are effective for 5th Graders' environmental learning.

Introduction

With global environmental issues being constantly raised, global warming and greenhouse effect have received considerable attention in recent years. Shocking pictures in the documentary film *An Inconvenient Truth* and *Beyond Beauty - Taiwan from Above* indicate that various countries and regions must face and work together to settle global environmental issues. Destroying the natural environment people live in may lead to ecological crises which will cause a series of problems for water resources, economy, society, climate, and food. These problems are essentially inseparable from environmental awareness, values, and attitudes of people. This encourages countries to start valuing environmental education. They believe that basic environmental education can help students rethink about the correlation between humans and the environment, start to understand their surroundings and consider environmental issues related to their lives. They also hold that only through education can we effectively increase students' environmental knowledge, awareness, and skills in environmental protection (Chin, 2013; Ho, 2013; Hsiao, 2015; Hsin & Chang, 2011; Hsu, 2016; Lin, 2013; Yang, 2011; Yang, 2016).

Because of the importance of environmental education to all of us, we need to do something more on environmental education. The major purpose of this study is to explore the learning outcomes on environmental education for 5th graders in Taipei.

Literature Review

Environmental Education in Taiwan

Environmental education has been promoted for decades outside Taiwan and involves an increasing number of people (Chou, 2001). Yang (1997) pointed out that rapid scientific and technological progress since the Industrial Revolution had made human lives much easier than before, but at the same time, it also destroyed the natural environment that human beings live in. Due to frequent natural disasters, all countries in the world have formulated laws and decrees to arrest the gradual deterioration of the environment. However, these laws and decrees do not solve the environmental problems because a great number of people lack awareness of

environmental protection. This means environmental education is the only effective way to stop people from destroying the environment.

The Belgrade Charter, which was proposed in 1975 at the International Environmental Workshop, defined the goal of environmental education as "to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones" (Yang, 1997).

At a conference held in Tbilisi, Georgia (USSR) in 1977 (UNESCO, 1978; Yang, 1997), UNESCO set goals of environmental education as follows: (1) to foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas; (2) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; (3) to create new patterns of behavior of individuals, groups, and society as a whole towards the environment.

Lee (1987) pointed out that many educators began to care about the environment and discuss the current or potential environmental problems in their class due to the popularity of environmental education. In addition, they would try their best to incorporate environmental knowledge and skills into their curriculum and learning activities. They hoped this could increase their students' awareness on environmental protection and make them care about their surroundings in daily life and not damage the environment. More importantly, these educators hoped that their students could take a proactive approach to environmental problems and master the knowledge and skills needed to deal with them.

Wang, Yang, and Tai (1990) held that environmental education was introduced to protect the environment and the natural ecosystem. They called on the public to care about the environment, proper use of natural resources, protect the natural ecosystem, culture, and properly handle the environmental problems. Hsu (2003) suggested that one of the main goals of environmental education was to emphasize the actions to address the environmental problems. Known as environmental actions or responsible environmental behaviors, these actions are the elements of environmental literacy.

Huang (2006) further explained that various environmental problems were the result of the overuse of natural resources. He maintained that controversial environmental problems could be called ~~as~~ environmental issues. He said controversial environmental issues should be further explored. This is because people from various cultural backgrounds may hold different values on this type of problem and it is difficult for them to reach an agreement on solutions.

The Environmental Education Act promulgated by the Taiwan's Legislative Yuan in 2011 clearly defines environmental education as: the application of educational methods to cultivate the understanding of citizens about their ethical relationship with the environment to improve their knowledge, skills, attitudes and values in protecting the environment and encourage citizens to treasure the environment and be active in public education that aims to achieve sustainable development.

The K-12 Education Administration of Taiwan's Ministry of Education amended the Grade 1-9 Curriculum Guidelines in 2012 (Ministry of Education, 2013). In the revised edition, the objectives of the educational curriculum were defined as follows:

1. Environmental perception and awareness: to cultivate students' perceptions of environmental degradation and pollution and their awareness of beautiful natural and artificial environment through training in perceptive skills such as observation, classification, sorting, spatial relationship, measurement, reasoning, prediction, analysis, and interpretation.

2. Conceptual knowledge of the environment: to educate students about the fundamental concepts of ecology, environmental problems (i.e. global warming, river pollution, nuclear pollution, air pollution, and debris flows), and their influence on the society and culture (i.e. sustainable development and biodiversity), and daily opportunities and actions of environmental protection (i.e. greenhouse gas reduction, resource reservation and recycling, simple living, and green consumption).

3. Environmental values and attitudes: to value environmental ethics and values, help students cultivate a positive attitude towards the environment, enable them to appreciate and be grateful for nature and the

ecosystem, embrace diverse cultures, care about underprivileged groups and the survival and development of future generations.

4. Environmental action skills: to develop students' ability to identify and study environmental problems, collect environmental data, propose and assess potential solutions, and analyze and take environmental actions.

5. Environmental actions experiences: to integrate environmental actions into students' learning activity, bring the courses alive, develop students' ability to handle environmental problems in their surroundings, and enable them to foster a sense of belonging and participation within their schools and communities.

From the above analysis, we can see that Taiwan's environmental education incorporates global environmental issues and local actions and the goals of the environmental education curriculum are the same with that of the environmental education defined by the 1975's Belgrade Charter and the categories of environmental education objectives formulated by the 1977's Tbilisi Declaration.

The promotion of environmental education helps society and individuals recognize and understand environmental problems, acquire environmental knowledge, cultivate environmental attitudes and values, develop the ability to solve environmental problems, and take positive actions. Only by putting environmental slogans into actions and incorporating environmental protection in daily life can environmental problems be completely solved. This will further promote sustainable development.

Learning and Instruction in Environmental Education

The increasingly serious environmental problems resulting from increasing scientific, technological, and economic progress cannot be handled merely by the instillation of environmental knowledge, a teaching method that cannot improve people's standard of living, or help achieve the goals of environmental education. Chou (1994) pointed out that lessons on environmental protection could not stimulate students' thinking, or encourage them to actively participate in environmental protection unless the instruction enables students to realize the impact of environmental change.

Lin (2005) further noted that learning about the environmental issues related to daily life could help students understand environmental concepts and knowledge involved in the issues and provide them with an opportunity to consider and discuss the conflicts or dilemma caused by these issues. Therefore, discussing the environmental issues arising with students could deepen their understanding of environmental problems, improve their learning outcomes, and help them learn to respect the environment.

Many researchers claimed that schools should integrate environmental issues into all courses. By participating in various teaching and learning activities, students could acquire wide knowledge for environmental protection, be aware of the impacts of environmental changes, reinforce positive attitudes and values to environmental problems, make proper environmental decisions and take appropriate actions (Chang, 2017; Chou, 1994; Kao & Chang, 2016; Lin, 2005; McGowan & Buttrick, 2017; Treagust, Amarant, & Chandrasegaran, 2016).

Chang (2001) expressed his opinion on environmental education curriculum and instruction: A course that includes environmental issues must contain environmental perception and awareness, the conceptual connotation of environmental knowledge, environmental ethics, environmental action skills and experiences, and systematically integrates these five aspects. The goals of the Grade 1-9 curriculum emphasize the relationship between individuals and their physical and mental development, individuals and social culture, and individuals and the natural environment. These three aspects can also be found in the goals of environmental education. Based on the assumption that everyone should be responsible for environmental problems, environmental education aims to develop individuals' positive attitudes towards the environment, encourage their active participation in environmental actions, and promote their self-development. Environmental education is not limited to ecological conservation but involves the interaction between humans, society and the environment. A case in point is a recent issue on social justice and environmental justice. The issue has attracted international attention for it stresses the social goals of environmental education. In contrast, the human-nature relationship is the fundamental concern of environmental education

Most studies on environmental issues and environmental education involving elementary school children in Taiwan focused on the design of environment-based learning activities (Chang, 2001, 2017; Chou, 1994, 2000; Kao & Chang, 2016; Lin, 2005; McGowan & Buttrick, 2017; Treagust, Amarant, & Chandrasegaran, 2016).

These activities were designed to help students acquire environmental knowledge from their daily lives, improve environmental attitudes and behaviors, and develop positive environmental literacy.

Chou (2000) pointed out that the teaching strategies and methods adopted to implement environmental education must be flexible and diverse. He claimed that in view of subjects, learning environment, and other conditions, teachers could teach lessons indoors or outdoors by using the traditional lecturing approach, values clarification, or encouraging active learning through problem-solving activities.

Yang (1991) noted that the UNESCO-United Nations Environment Programme (UNEP) International Environmental Education Program recommended various teaching methods, such as group discussions, class discussions, brainstorming, debate, role-playing, simulation, and games for classroom instruction while field trips and environmental trails for outdoor teaching.

Yang (1997) suggested that outdoor education was the most effective approach in developing students' awareness, appreciation, and understanding of the environment. Due to the setting of outdoor lessons, the teaching methods and strategies adopted are often different from those used in the classroom. Outdoor learning is student-centered and students' surroundings are used as the teaching materials, which tackles cultural, social, natural, and environmental issues. Its purpose is to initiate students' active inquiry, stimulate their learning motivation, and improve their learning interest. Combining classroom knowledge with field observations helps students cultivate positive attitudes towards problems before taking proper actions to solve them.

Hungerford and Volk (1990) pointed out that true environmental literacy meant responsible environmental behavior. Through the designed environmental education curriculum, environmental education provides students with a good opportunity to thoroughly learn concepts of environmental protection and the interrelation between humans and the environment. The deep learning can enhance students' environmental sensitivity and responsible environmental behavior by helping them to better understand the environmental problems and acquire environmental skills for analyzing and investigating environmental problems.

On the other hand, many researchers noted that environmental trails not only offered people an opportunity to travel, go sightseeing, and get close to nature but they can also be used for environmental education by merging various recreational stations into one mountain trail with display boards. On one hand, this increases the chance to be close to nature, including wild plants and animals (Demirbas, 2017; Hsu, 1979; Huang & Luo, 2013; Lin, 2016; Tsai, 2011). On the other hand, this takes into account the economic purpose and environmental protection factors. By limiting tourists' routes, it reduces the impact on the environment and keeps natural resources from artificial damage.

Using environmental trails for outdoor teaching will be of great benefit to individuals' physical and psychological health, acquisition of interpersonal relationships and the environment, and awareness of the importance of environmental protection. Mountain hiking is an activity through which participants can directly be with nature while outdoor environmental education is carried out outside classrooms. Both are inseparable from the outdoor environment.

Mountain hiking enables students to acquire knowledge related to the natural environment and ecosystem based on their own experience with nature. Besides, the outdoor activity can arouse students' learning enthusiasm and improve their learning efficiency. Admiring the beauty of nature can help students cultivate positive attitudes towards the environment and reduce environmental pollution and destruction. The purpose of outdoor environmental education is to help the public develop basic environmental literacy through the combination of outdoor teaching activities and the environmental education curriculum, to make them value environmental and ecological protection and pursue the sustainable development of the environment with positive environmental values.

Hiking trails rich in natural resources do not only provide learning materials for environmental education but are a perfect place for outdoor learning activities. The biodiversity of the trails can supplement a school environment. Thus, if educators can make the best use of the natural resources around hiking trails to design an environmental education curriculum, hiking trails will perform their leisure and recreational functions and students will have understanding and experience with the environment.

In addition, many other researchers pointed out that science museums and theaters could be used to promote environmental education. Studies show that these teaching activities did help learners improve their environmental literacy (Huang, 2015; Lin, Chang Chien, & Tseng, 2017; Parks, 2017; Yang, 2015).

The above analysis shows that environmental perception, attitudes, and behaviors can be cultivated during elementary school years. Integrating environmental issues into the curriculum will influence learning outcomes. In addition, teaching venues can be changed from classrooms to outside of schools such as mountain hiking activities. Outdoor education enables students to enter forests and have a direct contact with nature. It can also improve students' perceptions of the ecosystem and the environment, arouse their curiosity and observation, make them take the initiative to explore and discover environmental problems, cultivate their willingness and determination to cherish and protect the environment, motivate them to care about their surroundings and take active environmental actions. In this way, the goals of environmental education can be achieved.

Method

A quasi-experimental design with a single group was used in this study. Students of 24 fifth graders from an elementary school in Taipei participated in this study. The instructional design of this study is focus on environmental issues in Taiwan. Issues of climatic adaptation, environmental pollution, and environmental sustainability were selected from the goals of the environmental education curriculum formulated by Taiwan's Ministry of Education as the axes of environmental issues. From these three major issues, eight sub-themes were singled out as topics of self-compiled teaching materials and classroom instruction, including global warming, river contamination, nuclear pollution, air pollution, debris flows, sustainable development, biodiversity, and greenhouse gas reduction. In addition, the garbage problem was added as the ninth topic of environmental education.

Starting from students' surroundings, this study used local environmental issues to arouse their learning motivation and helped them explore environmental issues from teaching activities through group discussion and brainstorming. Finally, the teaching environment was extended outside the schools, coupled with the implementation of hiking activities. Outdoor teaching provides students with a good opportunity to experience the natural environment and enter forests, and have a direct contact with nature. Besides, it can also enhance their perception of the ecosystem and the environment, arouse their curiosity and observation, encourage them to explore and discover environmental problems, and cultivate their willingness and determination to cherish and protect the environment.

Five-week environmental education activities were carried out inside and outside the classrooms, including twelve indoor classes and four outdoor ones. The indoor classes were mainly about local environmental issues in Taiwan and were taught using lectures, films, and discussions. The researchers intervened with the teaching through observations and teaching feedback sheets. When necessary, they interview the participants to understand their experiences with the lessons and welcome their feedback. Films centering on environmental issues like Our Island, a documentary of the Taiwan Public Television Service, were selected as teaching aids. Outdoor classes were conducted through mountain hiking activities which provided a good chance for students to experience nature. The researchers hoped that through these outdoor activities students will see the importance of environmental and ecological protection, care for the environment, and take active action against environmental problems.

Considering the stamina and safety of subjects, distance, time and other factors, the researchers decided to conduct a field trip at the Elephant Mountain Hiking Trail in rural Taipei. The trailhead is very easy to recognize and the trail has a convenient route with even pavement and clear indicators. Anyone can walk the whole path with ease. Hiking the mountain trail to explore the nature combines environmental education with recreation.

Three research instruments were used in this study, including an environmental education achievement test, an attitude toward environmental education scale, and an attitude toward environmental action skills scale. The achievement test was designed to measure fifth graders' learning outcomes on environmental issues in Taiwan. The test consists of 24 items, with the index of discrimination items ranging from .20 to .67 and the reliability at .71. The attitude toward environmental education scale was meant to measure the subjects' environmental attitudes. The scale consisted of 23 items with a reliability of .84. The attitude toward environmental action skills was intended to measure the participants' environmental action skills. It comprised of 27 items with a reliability of .96. On the other hand, these three instruments showed great validity, which was verified by three environmental education experts.

This study collects both quantitative and qualitative data for the analyses. The quantitative data are the scores from three research instruments, including an environmental education achievement test, an attitude toward

environmental education scale, and an attitude toward environmental action skills scale. After obtaining the results of the test and the scales, this study used *t-test* to analyze the quantitative data collected. The qualitative data are mainly taken from the learning feedback of the participants, which are used as the main sources for qualitative data analyses. This paper uses *italic* font to present the feedback from participants as the qualitative data for the analyses. To achieve good reliability and validity for this study, three environmental education researchers first conducted a triangulation and cross-case inductive analysis on the qualitative data (Bogdan & Biklen, 1982; Guba & Lincoln, 1999; Patton, 1999; Silverman, 2000), following which a validity examination was completed to confirm the reliability and consistency of the data analyses and results.

Results and Discussion

Students' Performance in Learning Environmental Issues

In order to understand students' performance in environmental perception after they participated in the environmental education curriculum, this study designed an environmental education achievement test for the pretest and the posttest. The scores were then used to conduct the paired samples *t-test*. The results are shown in Table 1.

Table 1 *t-test* summary for environmental education achievement test

	N	*Mean*	*SD*	*t*
pretest	24	14.32	3.34	7.47***
Posttest	24	18.25	2.97	

*** $p < .001$

Table 1 shows that students scored higher in the posttest than in the pretest, $t = 7.47$, $p < .001$. The results of the *t-tests* revealed that after attending environmental classes, students made significant progress in their environmental perceptions. This means that teaching environmental issues in class could effectively improve students' environmental knowledge. The findings are consistent with the findings of Demirbas (2017), Kao & Chang (2016), Lin (2015), and Yang (2016).

The following are some students' feedback selected from the interviews and feedback sheets:

(1) *David said what he learned was people should avoid deforestation because it could cause debris flows and reduce oxygen emission. Besides, if only retaining walls were set up without taking proper water and soil conservation measures, no matter how high and thick the walls were, they could not block the debris flows that would destroy houses.*

(2) *Cathy said increasing greenhouse gases like carbon dioxide will lead to global warming. The warmer weather melts the icebergs or glaciers in the Arctic and the Antarctic. This made it impossible for living things to survive. Now the climate in Taiwan has becoming unstable. Because of this, the living space for many coastal residents is dwindling. So, we should save energy and reduce carbon dioxide emissions.*

The feedback from David and Cathy showed that after studying the issue of debris flows students could understand that environmental and climatic changes were partly caused by the overall change in nature and partly by humans. For example, excessive exploration had destroyed the best natural protection mechanism of mountains and forests. If we still adopted temporary remedies, tragedies caused by debris flows will continue to repeat and more people will lose their life and property.

(3) *Kathryn said that some exotic species might be good to us but they might also bring some problems. She thought that exotic species should not be introduced into Taiwan to affect the local ecological system. At present, an increasing number of exotic species were threatening our ecosystem, making local species on the verge of extinction. So, we should protect the original ecosystem and keep it from exotic species.*

(4) *Cathy said that after watching the films, she realized that there were so many exotic plants and animals in Taiwan. She had a horrible feeling that she could not describe it in words. Due to improper introduction, a great many exotic fish and plants were destroying the ecological system of rivers in Taiwan.*

(5) *Carla said that although exotic species and local ones had their own advantages, greater efforts should be made to protect local creatures. She hoped that exotic species should not be introduced or abandoned without purpose for it would cause gradual reduction of local living things.*

The feedback from Kathryn, Cathy, and Carla showed that students believed that exotic species could be introduced in Taiwan for economic reasons. However, when these species affect the original natural ecosystem or force local living things on the verge of extinction, the protection of local species must be put on the top of the list and unintended introduction or abandonment should be prevented to avoid potential damage to Taiwan's ecosystem. Due to the constant damage to their habitats, many native animals were forced to move to other places suitable for their survival. After they moved, their original home would be occupied by exotic species. Therefore, the number of exotic species must be well controlled. Otherwise, they would destroy Taiwan's ecological balance and cause the extinction of native species in Taiwan.

Students' Outcomes in Learning Environmental Attitudes

In order to understand the students' outcomes in environmental attitudes after they took the environmental education curriculum, this study designed an attitude toward environmental education scale for the pretest and the posttest. The scores were then used to conduct the paired samples *t-test*. The results were shown in Table 2.

Table 2 *t-test* summary for attitude toward environmental education scale

	N	*Mean*	*SD*	*t*
pretest	24	91.87	10.59	4.10***
Posttest	24	98.70	8.40	

*** $p < .001$

Table 2 shows that students scored higher in the posttest than in the pretest, $t = 4.10$, $p < .001$. The results of the *t-tests* reveal that after attending environmental classes students did make significant progress in their environmental attitudes. This means teaching environmental issues in class could effectively cultivate students' positive environmental attitudes. The findings are consistent with the findings of Lin (2013), Parks (2017), Yang (2015), and Yang (2016).

The following are students' feedback selected from interviews and feedback sheets:

(1) *Timothy said that he needs to get into the habit of turning off the light when he left a room. He had wasted much electricity because he often forgot to do that. He also noted that he would use more public transport from now on for that would reduce the emission of exhaust gases. He believed that as long as everybody made his/her efforts, global warming could be stopped.*

(2) *Natalia said that she wanted to develop good habits of protecting the environment daily, such as taking the bus and the Mass Rapid Transit (MRT) more, cutting down trees less, not turning down the air conditioner to a lower temperature, eating less meat and more vegetables and fruits. These habits could slow down global warming.*

The feedback from Timothy and Natalia showed that most students think they should save energy and reduce carbon dioxide emissions from daily life activities to slow down global warming. This means that after studying the issue of global warming, students could understand the impact of global warming and global climate change on human lives and properties. Global warming was caused mainly by human behaviors, such as deforestation and emissions of greenhouse gases from industry, traffic and daily life activities. In order to reduce a series of problems caused by global warming, everybody must ensure energy conservation and carbon dioxide emissions reduction in daily life. Through practical actions, such as: turning off lights when not in use, using public transport, energy conservation and carbon dioxide emissions reduction these will no longer just be a slogan.

(3) *David said that people did not take garbage seriously but as long as each of us littered every day, the accumulated garbage would cover the whole Taiwan in a matter of days. The litter will then be eaten by land animals which become human food. In other words, the litter people throw would come back to them.*
(4) *Robert called on people to be civic-minded and not to throw rubbish into the ocean. Otherwise, a garbage patch that is 40 times larger than Taiwan would be formed. The garbage would be swallowed by ocean animals which will be caught and eaten by humans. In other words, eating these seafood means eating garbage.*

(5) *Natalia noted that garbage collection and classification should be well performed and littering should be eliminated. If everybody could do that, albatrosses would not mistake garbage for food and die and there would be no super garbage dump, "trash soup", and garbage land on the sea. But no amount of regret could change the situation. If everybody does not litter and sorts garbage before dumping from now on, it is never too late*.

Students were asked to think about the consequence of littering after presenting how the albatrosses on the Midway Atoll ate plastic products by mistake and died. The feedback from David, Robert, and Natalia showed that students have realized that garbage, if not properly disposed, will not only pollute the environment but kill living creatures as well. Even worse, the toxins inside the creatures that have consumed garbage by mistake can enter human bodies through the food cycle. This environmental issue is designed to arouse people's environmental awareness about the threats of plastic trash and to educate people of the need to use substitutes for plastics. Therefore, we should replace plastic products with other alternatives as soon as possible and take measures to prevent plastic trash from flowing into the ocean. Saving the ocean and the earth means saving humans.

Students' Learning Outcomes in Environmental Action Skills

In order to understand the students' learning outcomes in environmental action skills after they participated in the environmental education curriculum, this study designed an attitude toward environmental action skills scale to be used as a pretest and posttest. The scores were then used to conduct the paired samples *t-test*. The results are shown in Table 3.

Table 3 *t-test* summary for environmental action skills scale

	N	*Mean*	*SD*	*t*
pretest	24	102.29	16.85	3.63**
Posttest	24	111.33	10.69	

** $p < .01$

Table 3 shows that students scored higher in the posttest than in the pretest, $t = 3.63$, $p < .01$. The results of the *t-tests* reveal that after attending environmental classes, students did make significant progress in their skills to take environmental actions. This means teaching environmental issues in class could effectively cultivate students' positive and correct skills to take environmental actions. The findings are consistent with the findings of Lin (2016) and Yang (2015).

The following are students' feedback selected from the interviews and feedback sheets:

(1) *Karen believed that combating global warming will not depend on the government or factories only and everybody should play a part in it. She suggested starting with changing daily behaviors, such as taking a bus more and driving less. A small change means a more beautiful earth*.

(2) *Melissa said that less streamside barbecue could reduce air pollution and eating roast meat less is good for our health. Her other suggestions included buying electrical appliances with green marks, use of reusable bags and the way to make the room air fresher by setting the air conditioner to a lower temperature for a while and turning it off and use the electric fan instead*.

Global warming must be a concern around the world. It affects not only a single country but many countries. It is not only about humans but about the sustainability of living things on the earth. The feedback from Karen and Melissa showed that students believed that to curb global warming, people must start saving energy and reduce carbon dioxide emissions as their daily habits. Global warming is an issue that requires everyone's concern and attention. It is also an environmental issue in which everyone can make a contribution. Combating global warming must start now.

(3) *Jennifer held that mangroves offer great benefits to nature but not every place is suitable to grow them. Therefore, she suggested that careful assessment should be made before growing the tropical tree in order to avoid spending money to remove them*.
(4) *Laura maintained that mangroves could be planted in some places to protect coasts and preserve biodiversity. She also pointed out that if the tropical shrub were cultivated in places that were not suitable for them, there would be adverse effects.*

The feedback from Jennifer and Laura showed that students could ponder the reasons for unsuitable plantation from an ecological perspective. Growing plants without serious consideration cannot beautify the local landscape. On the contrary, it may ruin the original local ecosystem. The ecological disruption caused by the improper plantation of mangroves is merely the tip of the iceberg. However, many ecological restoration projects should not focus on man-made destruction only because the restoration sometimes may cause serious and tough ecological problems. The protection of mangroves requires thorough assessment and consideration for they play a role in maintaining the ecological balance. The point is not to destroy the natural ecosystem when you mean to green an area.

Students' Other Learning Feedback

Natural trails in the mountains have diverse natural aspects and abundant life. They provide routes for people to get close to the mountains and take a good look at mountain scenes. However, they hope that people just leave their footprints but not trash on the trails, leaving mountain forests much more space for natural development and multiplication so that the animals and plants living there can grow up and thrive without man-made disturbance.

The following are some of the students' feedback selected from the interviews and feedback sheets:

(1) *Peter said that he felt very comfortable when he was walking on the Elephant Mountain Hiking Trail where he saw many trees, heard melodic bird songs, and smelled strong fragrance of flowers*.

(2) *Monica said that she saw various animals and plants at the Elephant Mountain Hiking Trail, heard the clatter of rain, and smelled the fragrance of flowers and grass. When she climbed to the top, she felt very comfortable and had a sense of accomplishment.*

(3) *Cathy said that she saw beautiful landscape, heard the clatter of rain, and smelled the fresh air at Elephant Mountain Hiking Trail. Although she was tired, the fresh air made her very comfortable*.

The feedback from Peter, Monica, and Cathy showed that walking on the Elephant Mountain Hiking Trail students could see fresh and green trees and various animals, smell the fragrance of flowers and grass, and breathe the fresh air. They could also hear the clatter of rain. In a leisurely and carefree mood, they could fully experience the joy of hiking and the sense of accomplishment except for a little tiredness.

(4) *Michael said that in the mountain forest he should not drop litter, nor snap twigs, but help to pick up trash and respect the living environment of wild animals*.

(5) *Melissa said that in the mountain forest she should respect wild animals, not drop litter, nor pluck twigs, nor catch insects, nor pollute the water resources, nor inscribe letters on trees.*

Michael and Melissa suggested that people should avoid littering, breaking twigs, catching wild animals, trampling grass, and making a lot of noise but respecting the habitats of animals and plants in the mountain, protecting the original landscape, and respecting other users of mountain forests. Hiking trails lead us into mountain forests, providing a route for us to understand and experience nature. When you keep an eye on your surroundings while walking on the trails, you can feel the forests and the beauty of nature. The above feedbacks indicate that mountain hiking activities do provide a good opportunity for students to get close to nature and experience nature and at the same time arouse their respect for nature and care for life. This means that outdoor education can truly enhance students' environmental literacy.

Conclusion

Based on the meaning of environmental education to sustainable development, this study integrated Taiwan's environmental issues into environmental education activities to explore the performance of fifth graders in learning these issues. After following the teaching activities, the participants did improve their perception on the environmental issues in Taiwan, including significant dimensions: climate adaptation, environmental pollution, and environmental sustainability. The findings are consistent with the findings of Demirbas (2017), Kao & Chang (2016), Lin (2015), and Yang (2016). This means that the environmental education curriculum and

corresponding teaching activities are helpful in enhancing students' ability to understand the environmental issues in Taiwan.

In addition, after learning the environmental issues in Taiwan, the subjects' scores in the posttest for environmental attitudes and skills to take actions were significantly higher than in the pretest. The findings are consistent with the findings of Lin (2013), Lin (2016), Parks (2017), Yang (2015), and Yang (2016). This indicates that teaching activities can improve students' environmental attitudes and skills to take actions. The results were congruent with the qualitative feedbacks from students.

In conclusion, this study maintained that the environmental education curriculum does contribute to improving the fifth graders' performance in learning environmental issues.

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