The Assessment of Junior High School Students' Environmental Knowledge and Attitude

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ABSTRACT. This study was aimed to explore junior high school students' environmental knowledge and attitude as well as the effect of integrated teaching of environmental education. In addition, by finding the solutions to questions raised in implementing the integrated environmental education, teachers' expertise was enhanced. The findings included: 1. Only "grades" contributed the significant difference on environmental knowledge among the students; 2. Subject students made a significant progress on environmental knowledge after being received environmental education; 3. Subject students also made a significant progress on environmental attitude after being taught in the class; 4. Using integrated teaching to design an environmental education curriculum could motivate students to learn as well as improve teachers' ability to create their own teaching materials.

Keywords: carbon emission reduction and energy saving, environmental education, integrated teaching, junior high school students, resources recycling

I. Background and motivations

Global warming, climate change, environmental destruction and food shortages have severely threatened humans and the environment (EPA, 2008). To resolve these dire environmental issues, in addition to seeking resolutions from technology, the ultimate solution to the problems depends on in-depth environmental education in a long run so that everyone can take proactive measures to safeguard the environment from diverse aspects such as cognition, values, and attitudes (Allman, 1972).

Environmental education is a nationwide, lifelong, integral, and sustainable education. It is proved that the environmental concepts formed by students during the compulsory education stage have great impact for their future environmental protection actions (Bauer, 1994) (Yang, 1998). It is also noted that countries around the world have incorporated environmental education in school curricula. In Taiwan, *Science and Technology* curriculum for the Grade 1-9 Curriculum promulgated by the Ministry of Education (hereinafter MOE) includes cultivating the concept and affection of

environmental education as part of the curriculum in order for students to possess the environmental protection concept and therefore apply the concept in daily life. Hence, the second motivation of this study was to investigate whether it was feasible to use environmental education integrated teaching in the *Science and Technology* curriculum and how effective it was.

Thus, the last motivation of the study was to investigate whether it was effective and workable to integrate education with life by integrating education into daily life, instructing students and letting them make compost by their own hand from the food waste on campus.

Purpose of the study

The environmental concepts formed by students during the years of their junior high school education have significant impact for their future environmental protection actions. If a student could obtain a wide range of environmental knowledge and develop social morality during this stage, it would affect his or her environmental behavior. Once he or she brought the environmental consciousness home, not only the family members but also the whole society would be impacted and changed (Che, 1996). The selected subjects concerning environmental education in Science and Technology curriculum of MOE include resource recycle, environmental destruction, global warming, and energy issues. The integrated teaching combined the daily life into education in order to achieve the following objectives. (Hounshell, 1973)

- (1) To understand the status of subject students' environmental knowledge and attitude
- (2) To understand if there was a significant progress on student's environmental knowledge after the environmental education
- (3) To understand if there was a significant progress on student's environmental attitude after the environmental education
- (4) To find solutions to questions raised in the environmental education so that researchers could improve their teaching expertise.

Research limitations and hypothesis

(1) Limitations

Due to the characteristics of the research background, objectives and questions, this study used the method of case study. Yet, because the researcher also possessed the characteristic of "research tool", personal opinions and/or ideology might affect the study procedure or results.

(2) Search hypothesis

The hypotheses of this study included:

Hypotheis 1. Gender and grade in the subject students has significant difference in environmental education.

- Hypotheis 2. Parents' education of the subject students has significant difference in environmental education.
- Hypotheis 3. Gender and grade in the subject students has significant difference in environmental attitude.
- Hypotheis 4. Parents' education of the subject students has significant difference in environmental education.
- Hypotheis 5. Subject students' environmental knowledge has significant difference after implementing the environmental education.
- Hypotheis 6. Subject students' environmental attitude has significant difference after implementing the environmental education.

II. Literature Review

(1) Environmental Knowledge

The so-called environment can be defined as a generic term that contains various natural resources and human-impacted natural factors that affect humans' survival and development. It includes sunlight, air, water, soil, land, minerals, forests, wildlife, landscape and recreations, socio-economics, culture, humane and historical monuments, natural ruins and natural ecosystems (Article 2 of Environmental Basic Law). Environmental knowledge refers to legal knowledge and common sense related to environment. In this study, the accumulated scores the subject students gained were defined as the levels of awareness of environmental knowledge. The higher scores represent the better awareness of environmental knowledge.

(2) Environmental Attitude

Attitude means a long-lasting and consistent tendency an individual holds toward a person, an object, or the surrounding world (Chang, 1991). Thus, environmental attitude can refer to an individual's concept and recognition toward the environment (various natural resources and human-impacted natural factors that affect humans' survival and development, including sunlight, air, water, soil, land, minerals, forests, wildlife, landscape and recreations, socio-economics, culture, humane and historical monuments, natural ruins and natural ecosystems). In this study, the accumulated scores the subject students gained were defined as the levels of awareness of environmental attitude. The higher scores represent the better awareness of environmental attitude.

(3) Integrated Teaching

Integrated teaching meant a combination of supplementary material with the content in the textbooks; that is, supplement additional teaching material to the original teaching material in the textbooks. This study integrated environmental education into Science and Technology curriculum of

the Grade-9 Curriculum and "transformed" the learning as part of the curriculum instead of an added extra curriculum. In this way, additional teaching and learning loads could be avoided, thus preventing elbowing the hours of other classes.

III. Research Methods

The research method applied in this study were experimental teaching, questionnaire survey, and semi-structured interview. The research procedure is shown in Figure 1.

(1) Research procedure



Fig. 1. Research Flow Chart

It should be centered in students to cultivate their abilities instead of instilling them acknowledge in traditional ways. The structure that emphasizes on the theme of living and cooperative learning uses this concept as core to integrate various courses. (Ministry of Education, ROC, 2004) The ideal of the study was based on John Dewey's "education is life itself". To help students to be aware of environmental protection and to implement it in daily life, the study carried out an integrated teaching on environmental education as the major means and questionnaire as supplementary.

(2) Construction of the pre-test questionnaire

The first draft of the questionnaire was compiled based on the issues of *Science and Technology* curriculum published by Kang Hsuan Publishing which included environmental pollution, recycling, energy saving and carbon emission reduction; and a variety of papers, journals, and literature were also collected and analyzed as reference.

(3) Content validity of the questionnaire

The pre-test questionnaire was reviewed by environmental educators, scholars of related fields, and government environmental officials to establish its content validity.

(4) Pre-test

A pre-test prior to the experiential teaching activities was conducted to 22 students in Class Four, Grade 9.

(5) Experiential teaching

A total of 22 students in Class Four, Grade 9, of Taitung County were taught via integrated teaching on environmental education during the 9th Grade Science and Technology course, general activities, and after lunch break. This study incorporated the teaching units of environmental education in *Science and Technology* curriculum, compiled teaching materials and learning worksheets. The major issues such as greenhouse effect, energy problem, resource recycling, and environmental destruction were integrated into the course. Furthermore, students were arranged to watch films about environmental education and visit environmental sheds during the synthetic activity courses. They were also instructed to do compost from food waste on campus after lunch break.

(6) Post test

An after-test was conducted to the 22 students after environmental knowledge and attitude was taught. The collected data were analyzed by SPSS for Windows 11.0.

(7) Data collection and analysis

The study used questions and questionnaire as the testing and survey tools to understand students' status of environmental knowledge and attitude, and to compare the changes on these two aspects after the integrated teaching was implemented. Testing was conducted on students' environmental knowledge while students' basic information and environmental attitude was done with questionnaire.

The returned question sheets and questionnaires were data decoded and repetitively proofread, and then using SPSS for Windows 11.0 as the tool to do statistical analyses (Wu and Tu, 2007), including t-test, reliability, validity, descriptive statistics, and ANOVA.

IV. Results and Discussions

(1) Analysis on Environmental Education Teaching

Changes of Students' Environmental Knowledge prior to and after the teaching

Environmental knowledge was divided, by the researcher, into four categories: knowledge of resource recycling, of environmental destruction, of greenhouse effect, and energy problem. After analysis, it showed that there was progress on the knowledge of the four categories (see Table 1). Especially, the knowledge of energy problem made the most progress. Hypothesis 4 sustained.

Item	Prior to teaching	After teaching	Full score	
Resources recycle	13.9	16.9	20	
Green house effect	14.3	17	20	
Energy	10.3	17	20	
Environment destruction	14.5	17.5	20	
Total	53.2	68.4	80	

Table 1 Changes of Students' Environmental Knowledge prior to and after the teaching

Changes of Students' Environmental Attitude prior to and after the teaching

Figure 2 shows that there was a progress on students' environmental attitude after the teaching. Hypothesis 5 sustained.



Fig. 2. Changes of Students' Environmental Knowledge before and after the Teaching

(2) Learning effect on making food waste compost

After implementing the food waste compost making for two months, students were asked to fill in the learning worksheets as an investigation on learning effect. The responses were analyzed and compiled as shown in Table 2.

	Unaware		Fairly aware		Aware		Clearly aware	
Item	Before	After	Before	After	Before	After	Before	After
What is compost	11	1	5	5	5	6	0	9
Carbon nitrogen ratio	18	2	2	5	1	4	0	7
Moisture and ventilation	10	1	4	2	6	6	0	12
Decomposition degree	10	1	7	7	4	4	0	10
PH value	8	2	8	4	3	7	2	8
Resources	16	1	3	3	1	5	1	12

Table 2 Comparison of learning effect after making food waste compost

(3) Analysis of Semi-structured interview

The Semi-structured interview with open questions was conducted to students to understand more about the impact of the integrated teaching of environmental education combined with food waste compost making in *Science and Technology* curriculum. Most of the students, except few complained, received positive inspiration and assistance. This gave the researchers confidence to continue teaching students with a combination of environmental education with food waste compost build to increase students' learning effect.

V. Conclusions and Suggestions

The study was based on the above-mentioned research motivations, objectives, study architecture, and via questionnaires and interviews to explore the empirical results. Following is a sum-up of the results. The sources of environmental knowledge students received from are (from higher degree to lower): teachers, television and broadcasting, family members, textbooks, newspaper and magazines, handbooks, classmates, experts' speeches. From students' perspectives, the effective methods of resource recycling are (from the most effective to the least): enhancing public awareness and teachers as good examples; holding competitions or implementing severe punishment were not effective.

Students made significant progress on environmental attitude and performance after the environmental education. Particularly, they recycled resources more precisely, The analyzed outcome of the semi-structured interviews indicated that students learned a lot from the implementation of environmental education as well positive progress on environmental attitude.

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