

Discussion on Environmental Literacy for Students Participating in University Social Responsibility Practice

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Abstract—Based on the implementation of University Social Responsibility (USR) practice, takes A project of the “Construction of Green Environmental Education Co-learning Base” has been carried out by Da-Yeh University. The achievement of students’ environmental literacy in social participation should be a part of testing the effectiveness of the USR program. In this program three aspects such as the cognition, attitude of participatory learning, and the self-evaluated effectiveness of environmental literacy in questionnaire survey for students have been studied. A total of 145 questionnaires were collected to the high school students, university students and USR volunteers who participated in the four activities. Results show that students in the USR program for participatory learning presented environmental literacy in those three aspects as medium to high agreement in each activity. However, the performance of three aspects of overall environmental literacy is not related to gender or grade. Under the variable of the frequency of volunteers, there is a significant difference only in the aspect of effectiveness. It is inferred that the more frequency of volunteering, the better the effect. Those who have participated in environmental protection associations have better attitude and effectiveness, too. Students in the USR program had high significant and high correlations between personal characteristics, attitude, and effectiveness.

Keywords—environmental education, University Social Responsibility (USR), environmental literacy, participatory learning

I. INTRODUCTION

There is a growing recognition that University Social Responsibility (USR) should be integrated with university strategy and operation practices. USR advances that universities should go beyond the core functions of teaching, research, and service and voluntarily act beyond legal requirements to promote the public good and environmental sustainability [1]. Due to the abundant ecological and humanistic resources in Chenggong Camp of Changhua City, Taiwan, the USR program of Da-Yeh

University proposed to construct a “green environmental education co-learning base” with leading students and volunteers to conduct environmental resource inventory, activity plan planning, environmental education explanation, environmental information analysis, video recording and other related work [2]. The achievement of students’ environmental literacy in social participation should be a part of testing the effectiveness of the USR program. Recent reviews of research indicate that various combinations of formal, non-formal, and other environmental experiences for young people have contributed in different ways to the development of environmental literacy. Various types of formal and non-formal environmental education programs have contributed to gains in knowledge and shifts in attitude as well as values, and behavior [3]. Da-Yeh University is committed to fulfilling its social responsibilities, and also hopes to strengthen the local connection and cooperation with regional urban and rural development. Through various environmental education activities students are expected to understand, respond and take practical actions on real problems to improve their environmental literacy. In this program three aspects such as the cognition, the attitude of participatory learning, and the self-evaluated effectiveness of environmental literacy are explored.

II. RESEARCH FRAMEWORK AND METHODOLOGY

A. Environmental Literacy Connotation

The American Environmental Literacy Assessment Panel established the connotation of environmental literacy in 1995. The project framework is based on the needs of the current situation of environmental education implementation, the research on relevant variables and predictive variables of environmental action, and the goals and characteristics of environmental education, including cognition, skills, affection and behavior [4]. A conceptual structure diagram of environmental literacy has been established by Hines *et al.* [5], and Yang [6] re-organized it into eight elements with cognitive properties, attitude properties, and locus of control in Fig. 1. Those eight elements include:

- Three elements of a cognitive properties are knowledge of issues, ecological concepts, and environmental action strategies.
- Four elements of attitudinal properties are attitudes, values, beliefs, and environmental sensitivity.
- The element of locus of control is the belief in the individual's ability to change the external environment through his actions.

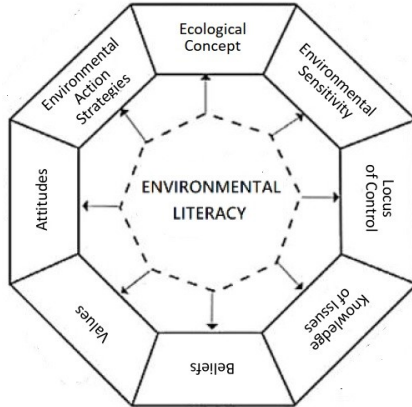


Figure 1. Environmental literacy model [6].

B. Aspects of Environmental Literacy Reviewing

According the definition of cognition by Hollweg *et al.* [3] those who are environmentally literate possess, to varying degrees:

- The knowledge and understanding of a wide range of environmental concepts, problems, and issues;
- A set of cognitive and affective dispositions;
- A set of cognitive skills and abilities; and
- The appropriate behavioural strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts.

In this program the evaluations for cognition of environmental literacy are [7]:

- Environmental sensitivity: assessing the extent to which the subject being able to feel, appreciate and care about the environment;
- Environmental responsibility: assessing the responsibility of research subjects to improve the environment;

- Intent to action: assessing the willingness of research subjects to engage in responsible environmental behaviour;
- Knowledge and understanding of ecology and environmental science: assessing the conscious knowledge of ecology and environmental science;
- Knowledge and understanding of environmental issues: assessing the conscious knowledge of major environmental issues in Taiwan.

According to environmentalists and social scientists, the attitude as well as behavioral intentions to sustainable consumption among citizens will help to nurture global environmental and economic sustainability and foster environment and human society development [8]. In this program the evaluations for attitude of participatory learning of environmental literacy are [7]:

- Ecological management: assessing the frequency with those who have exercised environmental actions in ecological protection in recent 3 years;
- Economic/Consumer action: assessing the frequency with those who have exercised environmental action in green consumption in recent 3 years;
- Persuasion: assessing the frequency with those who have exercised environmental actions in green persuasion in recent 3 years;
- Legal actions: assessing the frequency with those who have exercised environmental actions referring environmental legal in recent 3 years;
- Environmental hope: assessing the inner strength of those who in the process of solving environmental problems, which enables people to transcend current setbacks, and with a hope based on reality and full of confidence in a realistic and beautiful future.

Wilujeng *et al.* [9] analysed the effectiveness of learning using EESD-based student worksheets to improve environmental literacy. The Education for Sustainable Environmental Development (EESD) is a concept of education for sustainable development which points to various environmental dimensions.

Following this concept, the self-evaluated effectiveness of environmental literacy will be explored in this study for different environmental education activities, too.

C. Questionnaire Design

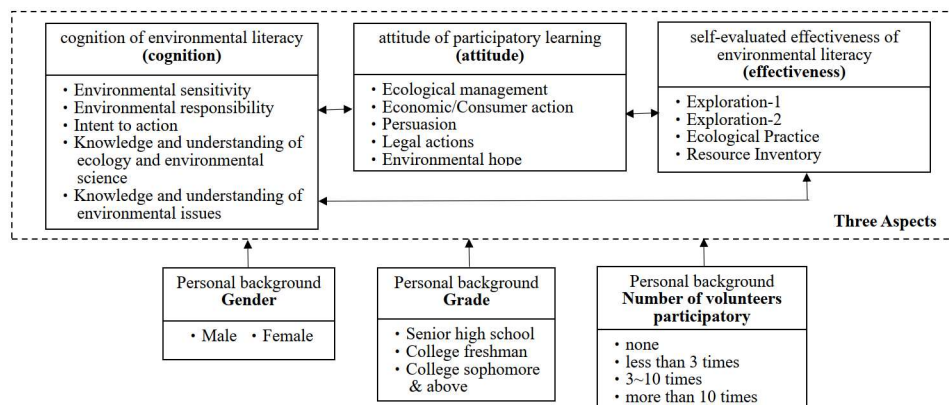


Figure 2. Framework of environmental literacy questionnaire [7].

Based on the researches of Hines *et al.* [5] and Yang [6], a “Environmental Literacy Questionnaire for Participatory Learning in Environmental Education” has been compiled. Three aspects such as the cognition, the attitude of participatory learning, and the self-evaluated effectiveness of environmental literacy are included. The framework of questionnaire is shown in Fig. 2. Likert’s five-point scale is applied to measure the level of agreement for the questions. For example, the five-point scale is “strongly agree, agree, no opinion, disagree, strongly disagree”.

After the questionnaire is drafted and the review is completed, six experts and scholars were invited to review the correctness of questions and whether they are accorded with the content of this study. A Content Validity Index (CVI) [10] test was applied through expert validity review. All the questions in questionnaire could pass the content validity.

D. Sample Objects of Study

This study is based on the students who participated in the USR program of Da-Yeh University. A total of 145 students and volunteers participated in four events were investigated. The four events are described below:

- Chenggong Camp Exploration Session I (Exploration-1): It is subject to the freshmen of the Department of Environmental Engineering of Da-Yeh University, in addition to the introduction of Chenggong Camp and tree climbing activities, there are also issues related to the conservation of Leopard Cat on Bagua Mountain;
- Chenggong Camp Exploration Session II (Exploration-2): It is subject to the students of Jhushan Senior High School with similar activities in “Exploration-1”;
- Haha Fish Farm Ecological Practice Activity (Ecological Practice): It is subject to the training activities of community volunteer students of Environmental Education Center for Da-Yeh University. The main purpose is to enable volunteers to fully understand and practice the relationship between food and agriculture education as well as environmental education, and they can assist in the design and management of environmental education activities in the school in the future;
- Environmental resource inventory activity in Chenggong Camp (Resource Inventory): It is subject to the training activities of USR participatory students. The purpose of environmental resource inventory is to investigate the ecological and human development characteristics of this region.

III. RESULTS AND DISCUSSION

A. Background Information Analysis for Sample Objects

A total of 145 questionnaires were sent out in this study, and a total of 145 valid questionnaires were responded, with an effective respond rate of 100%. According to the

three parts of the personal basic background information of the students participating in the USR program of Da-Yeh University, the background variables are analyzed by gender, grade and the number of volunteer participatory, as shown in Table I.

TABLE I. BACKGROUND INFORMATION ANALYSIS FOR SAMPLE OBJECTS

Variables	Category	Counts	Percentage	Rank
Gender	Male	99	68.3%	1
	Female	46	31.7%	2
Grade	Senior high school	41	28.3%	3
	College freshman	49	33.8%	2
	College sophomore & above	55	37.9%	1
Number of volunteers participatory	none	50	34.5%	1
	less than 3 times	29	20.0%	3
	3~10 times	28	19.3%	4
	more than 10 times	38	26.2%	2

B. Analysis of All Aspects of Performance Scoring

1) Aspect of cognition

Table II shows that the average score of the overall performance of the cognition is 4.19, and 73.1% of the students are inclined to a high degree of agreement (strongly agree and agree), indicating that the cognition of the USR students is moderate to high. The average score of “environmental sensitivity” was 4.34, but the average scores of “Knowledge of ecology and environmental science” and “Knowledge of environmental issues” were 3.99 and 3.97, respectively.

TABLE II. THE PERFORMANCE SCORING FOR ASPECT OF COGNITION

Items	Mean	SD	High degree of agreement percentage
Environmental sensitivity	4.34	0.82	78.3%
Environmental responsibility	4.31	0.83	77.9%
Intention to action	4.21	0.83	76.5%
Knowledge of ecology and environmental science	3.99	0.96	66.9%
Knowledge of environmental issues	3.97	0.99	65.5%
overall scoring	4.19	0.17	73.1%

2) Aspect of cognition

Table III shows that the average score in the overall performance of the attitude is 4.19, and 75.4% of the students are inclined to a high degree of agreement, indicating that the attitude of USR participatory students is relatively high. The average score for “Economy/Consumer Action” was 4.35, and the average score for “Ecological Management” was 4.01.

TABLE III. THE PERFORMANCE SCORING FOR ASPECT OF ATTITUDE

Items	Mean	SD	High degree of agreement percentage
Ecological management	4.01	1.00	66.9%
Economic/Consumer action	4.35	0.80	80.7%
Persuasion	4.23	0.81	76.6%
Legal actions	4.11	0.83	75.1%
Environmental hope	4.23	0.84	77.5%
overall scoring	4.19	0.12	75.4%

3) Aspect of effectiveness

Table IV shows that the average score in the overall performance of the effectiveness is 4.22, and 77.0% of the students are inclined to a high degree of agreement, indicating that the USR participatory students have acquired a high degree of effectiveness. The average score of “Ecological Practice” was 4.37, and the average score of “Exploration-1” was 4.04.

TABLE IV. THE PERFORMANCE SCORING FOR ASPECT OF EFFECTIVENESS

Items	Mean	SD	High degree of agreement percentage
Exploration-1	4.04	0.94	69.7%
Exploration-2	4.28	0.83	77.6%
Ecological Practice	4.37	0.73	88.2%
Resource Inventory	4.20	0.88	72.6%
overall scoring	4.22	0.10	77.0%

C. Inferential Statistical Results Analysis

1) Analyses of variables of different gender

From the results of independent sample *t*-test showed in Table V, it can be seen that the gender of students has no significant difference ($p > 0.05$) in all aspects, and it is inferred that the cognition, attitudes and effectiveness of environmental literacy are not related to gender.

TABLE V. INDEPENDENT SAMPLE T-TEST FOR GENDER IN ALL ASPECTS

Aspect	Gender	Count	Mean	<i>t</i>	<i>p</i>
Cognition	Male	99	4.16	0.681	0.497
	Female	46	4.26		
Attitude	Male	99	4.18	0.394	0.694
	Female	46	4.23		
Effectiveness	Male	99	4.21	0.140	0.889
	Female	46	4.23		

2) Analyses of variables of different grade

The ANOVA test results in Table VI show that there is no significant difference ($p > 0.05$) between all grades of students in all aspects, and it is inferred that the cognition, attitudes and effectiveness of environmental literacy are not related to grades.

TABLE VI. ANOVA TEST FOR GRADE IN ALL ASPECTS

Aspect	Gender	Count	Mean	<i>F</i>	<i>p</i>
Cognition	(1) Senior high school	41	4.39	2.052	0.132
	(2) College freshman	49	4.10		
	(3) College sophomore & above	55	4.13		
Attitude	(1) Senior high school	41	4.37	1.702	0.186
	(2) College freshman	49	4.13		
	(3) College sophomore & above	55	4.13		
Effectiveness	(1) Senior high school	41	4.35	0.963	0.384
	(2) College freshman	49	4.15		
	(3) College sophomore & above	55	4.18		

3) Analyses of variables of different number of volunteers participatory

The ANOVA test results in Table VII show that the number of volunteer participatory for students is significantly different ($p < 0.05$) only in terms of effectiveness. It is inferred that the effectiveness of environmental literacy is indeed related to the number of volunteer participatory, and the more the number of volunteers, the better the effectiveness. However, there were no significant differences in cognition and attitude, and it was inferred that personal cognition and attitude were not related to the number of volunteers.

TABLE VII. ANOVA TEST FOR NUMBER OF VOLUNTEER PARTICIPATORY IN ALL ASPECTS

Aspect	Gender	Count	Mean	<i>F</i>	<i>p</i>
Cognition	(1) none	50	3.99	1.919	0.129
	(2) less than 3 times	29	4.32		
	(3) 3~10 times	28	4.26		
	(4) more than 10 times	38	4.32		
Attitude	(1) none	50	3.97	2.647	0.051
	(2) less than 3 times	29	4.29		
	(3) 3~10 times	28	4.27		
	(4) more than 10 times	38	4.35		
Effectiveness	(1) none	50	3.98	3.312* (Scheffé) (4)>(1)	0.022
	(2) less than 3 times	29	4.24		
	(3) 3~10 times	28	4.37		
	(4) more than 10 times	38	4.41		

4) Correlation analysis

The results of Pearson's difference product correlation analysis in Table VIII show that there is a high degree of correlation (correlation coefficient between 0.80 and 0.99) among all aspects, and all of them are highly significant ($p < 0.01$).

TABLE VIII. CORRELATION OF COGNITION, ATTITUDE, AND EFFECTIVENESS

Aspect (N=145)	Cognition	Attitude	Effectiveness
Cognition	--		
Attitude	0.800**	--	
Effectiveness	0.814**	0.846**	--

** $p < 0.01$ highly significant

IV. CONCLUSION

The results of the research on the environmental literacy of students in the USR program of participatory environmental education are as follows:

- Those students have a moderate to high level of environmental literacy in the overall performance of "cognition", "attitude" and "effectiveness";
- The three aspects of "cognition", "attitude" and "effectiveness" are not related to gender as well as grade of students;
- The more students who are volunteer participatory, the better the effect of environmental literacy;
- The three aspects of "cognition", "attitude" and "effectiveness" are highly correlated for students participating in the USR program. In activity design, if students with good cognitions can strengthen their attitudes, they will be able to achieve good effectiveness.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Y-C Chen conducted the research and integrated the whole research; W-Y Su and M-R Lin analyzed the data; W-Y Su and M-R Lin wrote the paper; all authors had approved the final version.

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