중등교사들의 환경교육 수업에 대한 교사 전문성 분석

Korean Secondary School Teachers' Professionalism in Teaching Environmental Subjects

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ABSTRACT

The objective of this study is to find out the professionalism of secondary school teachers in teaching environmental subjects. This research was conducted using a questionnaire survey of 431 secondary school teachers from 34 schools in Seoul and Gyeonggi Province, Korea. A 5-point Likert scale self-evaluation questionnaire on their professionalism in environmental education was developed based on Hungerford *et al.*'s (1994) evaluation criteria. Two middle school teachers' classes were observed, and video taping and interviewing were also conducted. The survey analysis revealed that teachers evaluated their professionalism on environmental subjects to be a little above the middle of the scale. The mean values were 2.80 for the foundation level; 2.86 for the conceptual awareness level; 2.84 for the investigation level; 2.94 for the environmental action skills level; and 2.84 for the educational application level. However, class observations revealed that there was some gap between their self-evaluation of professionalism and their actual classroom application. Both classes were not that satisfactory with regard to 'the abilities to communicate and apply ecological concepts', 'the ability to clarify the roles of different value systems for environmental issues and personal values in decision making', 'the ability to clarify their own value system regarding solutions to environmental issues', and 'the ability to apply citizen action skills for solving environmental issues and for sustainable development'. The results provide a basic reference for the improvement of environmental-related education.

Key words : environmental education, secondary school, teachers' professionalism

초 록

이 연구의 목적은 중등교사들의 환경 관련 수업 전문성을 심층적으로 분석하는데 있다. 연구를 진행하기 위해 먼저, 서울과 경기도의 중등교사 431명을 대상으로 환경수업 전문성에 대한 자기평가를 실시하였다. 자기평가도구로는 Hungerford 등(1994)이 개발한 '환경교육자가 갖추어야할 능력 범주 기준'를 활용하였다.

그리고 자기평가를 실시한 중등교사들 중에서 2명의 교사가 진행하는 환경 관련 수업을 실제 참관하여 비디오녹화 분석하였고, 수업교사들과의 면담도 실시하였다.

환경 관련 수업 전문성에 대한 자기평가 결과, '생태학적 기초' 영역이 평균 2.80, 개념적 인식 영역이 평균 2.86, 조사와 평가 영역이 평균 2.83, 환경적 행위기능 영역이 평균 2.94, 교육적 적용 영역이 평균 2.84로 나타났다. 또한, 실제 수업을 분석한 결과, 환경관련 수업을 진행한 교사들은 현대 환경교육에서 강조되고 있는, '생태학적 지식을 교수학습에 효과적으로 적용하는 측면', '환경적 의사결정을 위해 개인적 가치를 명료화하는 측면', '환경쟁점과 해결책에 대한 자신의 가치관을 평가하는 측면', '환경적으로 지속가능발전을 위해 시민적 행위기능을 개발하는 측면'에서 다소 미흡한 것으로 나타났다. 이 연구는 중등학교에서 환경관련 수업을 담당하고 있는 교사들을 위한 환경교육 연수프로그램을 개발하고 운영하는데 의미 있는 시사점을 제공해 줄 수 있을 것이다.

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Ⅰ. Introduction

It has been generally accepted that environmental problems cannot be solved simply with science and technology but can be solved through complicated decision-making procedures involving social and political systems (Trudgil, 1990). Therefore, in order to help students acquire the right attitudes toward the environment, environmental education should be conducted by linking the methods and contents of different subjects, such as natural science, social science, art, humanities, and through an integrative and interdisciplinary approach, rather than through fragmented knowledge (Simmons, 2005; NAAEE, 2004; Choi, 2001; Kang, 1995; Kim *et al*., 2000; Ministry of Education of Korea, 1997; Nam *et al*., 1999). The Tbilisi Declaration of 1977 also emphasizes the importance of interdisciplinary and holistic approaches in environmental education (Palmer, 1998). The three teaching conditions for successful environmental education suggested by May (2000) also include 'holistic capability' which connects local and global issues as well as the foundations of knowledge and skill. Hart (2002) suggested STSE by adding E (environment) to STS (Science, Technology, and Society) to incorporate social and environmental dimensions within the science curriculum. The previous research all emphasizes the importance of holistic approaches and the role of teachers in environmental education. Because of this characteristic of environmental education, competent and enthusiastic teachers are indispensable for effective environmental education at school (Pooley & O'Connor, 2000).

Environmental education in Korea was first mentioned briefly in the 4th National Curriculum (promulgated in 1981), and was infused in the 5th National Curriculum (promulgated in 1987) in diverse school subjects, to be treated separately. The 6th National Curriculum (promulgated in 1992) included "The Environment" for middle school and "The Environmental Science" for high school as separate and independent subjects, although they were provided as elective courses. An eclectic approach was used to teach the subjects. The 7th National Curriculum (promulgated in 1997) maintained the two environmental subjects, although the title of "The Environmental Science" was changed to "The Ecosystem and the Environment." The 7th National Curriculum consisted of the National Common Basic Curriculum for 1st to 10th Grades and the Elective Curriculum for 11th and 12th Grades (Ministry of Education, 1997). The main problem of environmental education for this kind of curricular system is what we call "the peripheral treatment of the subject matter." In other words, since environment-related contents are taught not only in environment subjects but also in almost all other subjects, they may not be taught properly in any subject.

Surveys of the environment teacher retraining programs (Choi *et al*., 1992; Kim *et al*., 1995; Park & Choi, 1997; Hwang & Nam, 2001) revealed that sporadic and non-continuous programs made it difficult for teachers to actively participate and that the content of the programs was lopsided towards environmental pollution and preservation measures failing to capitalize on the characteristics of environmental education which requires interdisciplinary and multidisciplinary approaches. In addition, the education methods were mostly lecture-oriented and knowledge-centered lowering the teachers' level of satisfaction with the training programs (Choi *et al*., 2000). What is urgently needed, therefore, is the development and operation of a quality training program which enhances the professionalism of secondary school teachers.

As the saying goes, the quality of the education cannot surpass the quality of the teacher;

the success of environmental education depends on the ability of the teacher, i.e., their professionalism (Kim *et al*., 1995; Jegede & Taplin, 2000; Kirk & Macdonald, 2001). Therefore, it is necessary and meaningful to figure out if teachers of environmental subject matter are equipped with the professionalism they need before developing a training program.

This study aims to 1) investigate how teachers of secondary schools evaluate their professionalism in environmental subject matter; 2) analyze the professionalism in actual environment classes; 3) find out if there are any gaps between their self-evaluation and their actual in-class actions in terms of the professionalism; and 4) make suggestions which should be reconsidered to improve the environmental education programs.

Ⅱ. Method

To examine the professionalism of secondary school teachers, both quantitative and qualitative analyses were used. This study was developed through the following procedures:

First, self-evaluation of professionalism regarding environmental education was conducted through a survey. Then, the environment-related classes of two teachers were analyzed to see their strengths and weaknesses. These teachers were chosen based on their willingness to have their classes video taped. Third, the degree of the self-reported professionalism of the two teachers were compared with their observed professionalism. Finally, points for improving the environmental education program were suggested in order to improve the professionalism of the secondary school teachers.

1. The Self-Evaluation of Environment Teachers' Professionalism

The present study surveyed 249 junior high school teachers (from 19 schools) and 182 high school teachers (from 15 schools) in Seoul and Gyeonggi Province, South Korea, with a self-evaluation questionnaire made up of five-point Likert-type scales in order to investigate how the teachers evaluated their own professionalism in environmental education.

The abilities required of teachers of environment-related subject matter has been discussed since the 1970s (Choi, *et al*., 2007). Stapp (1975) said that teachers of environmental subject matter should be equipped with professionalism on environmental science and environmental education as well as education in general. UNESCO-UNEP (1990a) emphasized professional educational skills and the ability to apply the contents of environmental education. Hungerford *et al*. (1994) listed the abilities of ecological foundations, conceptual awareness, investigation, environmental action, and educational application. NAAEE (2004) accentuated professionalism in environmental literacy, the foundation of environmental education, the responsibility as an environmental educator, planning and practicing environmental education, encouraging learning, and overall analysis and evaluation.

Among the above studies, Hungerford *et al*. (1994) scale matches the most with the items of environmental education in Korea and also includes systematic and specific evaluation items for measuring the professionalism of teachers. Therefore, the instrument of classroom evaluation was adapted from Hungerford *et al*. (1994) evaluation criteria for teachers of environmental subject matter (See Table 1). The Cronbach alpha's of the instrument were as follows: α=0.8679 for Level 1, The Foundations; α=0.9007 for level 2, Conceptual Awareness; α=0.8838 for level 3, Investigation; and α=0.8766 for level 4, Environmental Action Skills. The Cronbach alpha for Level 5 (Educational Application) was not calculated since that category had a single evaluation item.

Table 1. Framework for the Self-evaluation of Environmental Education Professionalism (Hungerford *et al.*, 1994)

Goal level	Evaluation criteria	Score*				
		5	4	3	2	1
Level 1 [The foundations level]	The ability to communicate and apply major ecological concepts					
	The ability to understand ecological principles in order to investigate, evaluate, and solve ecological issues					
	The ability to use ecological knowledge in analyzing the cases of sustainable development and understanding ecological principles					
Level 2 [The conceptual awareness level]	The ability to understand and communicate about the impact of cultural activities on the environment					
	The ability to identify environmental issues and their ecological/cultural implications					
	The ability to identify environmental solutions and their ecological/cultural implications					
	The ability to clarify the roles of different value systems for environmental issues and personal values in decision making					
Level 3 [The investigation level]	The ability to use the knowledge and skills of investigation in integrating data					
	The ability to analyze the value systems regarding environmental issues from the perspectives of ecological and cultural implications					
	The ability to identify the value systems regarding the solutions for environmental issues					
	The ability to clarify own value system regarding the solutions for environmental issues					
Level 4 [Environmental action skills level]	The ability of various citizenly actions including environment-friendly action strategies					
	The ability to evaluate chosen actions from ecological/cultural perspectives					
	The ability to apply citizen action skills for solving environmental issues and for sustainable development					
Level 5 [Educational application]	The ability to apply educational materials for developing students' environmental attitude					

*5: very high, 4: high, 3: average, 2: poor, 1: very poor.

2. Analysis of Environment-Related Classes

To examine the educational status of environment classes, two middle school teachers from Gyeonggi Province and Chungcheong North Province were chosen for this analysis. Their classroom teaching was analyzed in order to investigate their strengths and weaknesses, using the techniques of classroom observation, video taping, and interviewing. Their self-reported professiona-

Table 2. The observed teachers and their classes

	School location	Grade	Total number of students	Class theme	Class type	Class time	Teacher	
							Gender	Years
Observation class 1	Gyeonggi Province	9th	41	1st taping: ecosystem and humans	lecture	1	female	2
				2nd taping: The compartments of environment	presentation	1		
Observation class 2	Chungcheong Province	7th	34	1st taping: the meaning of ecosystem/the compartments of ecosystem	game	1	female	2
				2nd taping: Bioaccumulation	lecture	1		

lism was compared with the professionalism revealed in their classroom teaching. The two participating teachers and their classes are described in Table 2. This study evaluated the professionalism of the two teachers separately based on the collected observation data, such as the observation notes, transcripts of the videotapes, and interview notes. Differences among the researcher ratings were corrected through discussions.

Ⅲ. Results and Discussion

1. The Results of the Teachers' Self Evaluation

Secondary school teachers of environmental subjects ranked their professionalism a little lower than the middle score on every level (Table 3). Overall, the mean value of their response to each question was a little higher than the middle score. The differences between questions were not statistically significant.

From the questionnaire answered by 249 middle school teachers, the level with the highest mean was Level 4, Environmental Action Skills (M=2.901), followed by Level 5, Educational Application (M=2.850); Level 3, Investigation (M=2.812); Level 2, Conceptual Awareness (M=2.808); and Level 1, The Foundations (M=2.804). For the 182 high school teachers, the highest mean was that of Level 4, Environmental Action Skills (M=2.995), followed by Level 2, Conceptual Awareness (M=2.929); Level 3, Investigation (M=2.874); Level 5, Educational Application (M=2.840); and Level 1, The Foundations (M=2.790).

Table 3. The results of the self-evaluation of environment education professionalism

Evaluation category	N	Mean (M)	Standard Deviation (SD)
Level 1: The foundations level	430*	2.80	.88
Level 2: The conceptual awareness level	431	2.86	.85
Level 3: The investigation level	431	2.84	.84
Level 4: Environmental action skills level	431	2.94	.89
Level 5: Educational application	431	2.84	1.06

*For level 1, one teacher did not respond.

The level that both middle school and high school teachers had difficulties with was level 1, the Foundations level. This demonstrates that the development of an in-service training program to help equip teachers with professional teaching knowledge is urgently needed since ecological knowledge is indispensable for understanding how natural systems and the interactional procedures between social systems and natural systems work (Volk & McBeth, 1996). The next level that teachers felt they were lacking professionalism was Level 2, the Conceptual Awareness level for middle school teachers; and Level 5, Educational Application for high school teachers. Level 2, the Conceptual Awareness level, includes the ability to relate social activities of human beings with ecological aspects and to clarify the roles of different value systems for environmental issues in the context of culture and personal values in decision making.

Sustainable education can be accomplished with this kind of interdisciplinary approach (Huckle & Sterling, 1996). Therefore, it is necessary to develop an environmental education program which incorporates conceptual awareness at the middle school level. With regard to high school teachers, they evaluated their educational application being the second least satisfactory on their self-evaluation. One of the most known environmental teaching materials is the 'Environmental Education Series (EES)' by UNESCO-UNEP (1990b), which suggests 'issues analysis, simulation and modeling, panel discussion and debate, behavior analysis, role play, field visit and observation'. Therefore, environmental educational programs with these kinds of approaches should be developed for high school teachers. Considering most environmental education materials are for elementary schools and middle schools, the necessity for developing educational materials for high schools should be emphasized.

The mean value of each item was also calculated (Table 4). The results indicated that secondary school teachers evaluated their own professionalism to be in about the middle of the scale, as the level means ranged from 2.80 to 2.94, and the item means from 2.68 to 2.97.

2. Qualitative Analysis of Environment-Related Classrooms

When we asked what was the most important among the five goals of environmental education (awareness, knowledge, attitudes, skills, participation) from the Tbilisi declaration, both teachers responded that awareness was the most important. The following are the interview transcripts related to this.

Teacher A: "In my opinion, effective goals are more important than cognitive goals in environmental education. It seems that students will participate in diverse programs and practice only after they acquire environmental awareness. I would like to lead my students to be aware of the environment through experience during the class time; however, I can hardly do that. The main reason is that a lot of time should be spent on preparing for each class. It is hard to do so, because there are too many things for teachers to do."

Teacher B: "I make efforts so that students can feel the environment and express it even though it is hard to lead classes the way I want since each environment class lasts for only one class period per week. The 'knowledge' can be acquired through diverse media. In contrast, it is hard to acquire environmental 'awareness' if teachers do not make effort deliberately. I provide students with a chance to watch plants and draw them in order to make them aware of the environment. These kinds of classes are effective because they provide students with fun and functional learning."

Although 'the development of an integrated perspective' in environment classes is emerging as an

Table 4. Results of self-evaluation items of each level for the professionalism of environment education

	Items	Both Middle and High School Mean (SD)	Middle School Mean (SD)	High School Mean (SD)	t
Level 1	(1) The abilities to communicate and apply major ecological concepts	2.91 (.97)	2.90 (.91)	2.96 (1.03)	-0.642
	(2) The ability to understand ecological principles in order to investigate, evaluate, and solve the ecological issues	2.76 (.97)	2.79 (.91)	2.76 (1.01)	0.339
	(3) The ability to use the ecological knowledge in analyzing the cases of sustainable development and understanding ecological principles	2.68 (1.04)	2.73 (.94)	2.65 (1.14)	0.713
Level 2	(4) The ability to understand and communicate about the impact of cultural activities on environment	2.93 (1.04)	2.94 (.92)	2.99 (1.09)	-0.450
	(5) The ability to identify environmental issues and their ecological/cultural implications	2.82 (.97)	2.74 (.88)	2.96 (1.03)	-2.372*
	(6) The ability to identify environmental solutions and their ecological/cultural implications	2.75 (1.00)	2.74 (.91)	2.83 (1.04)	-0.995
	(7) The ability to clarify the roles of different value systems for environmental issues and the personal values in decision making	2.82 (1.00)	2.80 (.88)	2.93 (1.02)	-1.335
Level 3	(8) The ability to use the knowledge and skills of investigation in integrating data	2.84 (.99)	2.85 (.88)	2.83 (1.10)	0.255
	(9) The ability to analyze the value systems regarding environmental issues from the perspectives of ecological and cultural implications	2.77 (.98)	2.72 (.88)	2.83 (1.10)	-1.120
	(10) The ability to identify the value systems regarding the solutions for environmental issues	2.82 (.97)	2.79 (.84)	2.90 (1.08)	-1.110
	(11) The ability to clarify own value system regarding the solutions for environmental issues	2.89 (.99)	2.89 (.86)	2.93 (1.08)	-0.424
Level 4	(12) The abilities of various citizen actions including environment-friendly action strategies	2.97 (1.03)	2.93 (.94)	3.04 (1.12)	-1.135
	(13) The ability to evaluate chosen actions from the ecological/cultural perspectives	2.93 (.95)	2.86 (.84)	3.02 (1.07)	-1.704
	(14) The ability to apply citizen action skills for solving environmental issues and for sustainable development	2.91 (1.03)	2.92 (.96)	2.92 (1.09)	0.058
Level 5	(15) The ability to apply educational materials for developing students' environmental attitude	2.84 (1.06)	2.85 (.98)	2.84 (1.15)	0.12

*$p<.05$

important part, teachers seem to have difficulties with it. The following excerpts from the interview illustrate this point.

Teacher A: "I think an integrative approach in

environmental education is very important. We can mention and relate the contents of other subjects when dealing with environmental issues. But presently, few teachers integrate other subjects, such as biology, chemistry, earth science, and physics. The reason is that teachers do not know how to integrate them even though they realize the importance of integration. Therefore, it is necessary to provide assistance from specialists in diverse majors. We should cooperate to develop environment education materials and share them through in-service training programs."

Teacher B: "I do think integrative education is really necessary in environment classes. When I talk about 'Borneo Island', I make efforts to cover social and political aspects. This is because I think integrative education is very important. Ecology and biology are frequently related in environmental classes. I think it is necessary to integrate the social aspect and to emphasize the functional aspect like investigation. For this, theme-oriented classes are more desirable than chapter-oriented classes. Also, we should be flexible in assigning class hours. Currently, environment classes are assigned one hour per week for 7th through 9th grades. In other words, two hours should be assigned per grade, or class time should be in block units rather than lecture units."

Both teachers thought that awareness is the most important; however, when teaching, they were not enhancing awareness as much as they wanted. In addition, integrative education was not implemented as much as it deserved. Therefore, the curriculum and in-service training programs should find ways to improve this area.

The following is a more detailed analysis of each class. The analysis is based on Cho's (2001) model of five stages of classroom instruction. The five stages are: (1) the ceremonial stage, (2) the checking stage, (3) the main stage (topical set), (4) the summary stage, and (5) the closing stage.

1) Teacher A's class

Teacher A mainly used the lecture method in order to explain the environmental content, using the topics and materials that the students experienced through TV or radio. The teacher did not check the learning of the previous class during the "checking stage", nor did she evaluate the students' learning during the "summary stage." An activity to enhance the students' environmental sensitivity and literacy is desirable at this stage, by reflecting upon the learning materials and exchanging the students' feelings about the lesson.

The Korea Institute of Curriculum and Instruction (2002) (henceforth, KICE) suggested the following five aspects for good classroom instruction: (1) curriculum and content, (2) instructional method, (3) classroom environment, (4) evaluation, and (5) the teacher's effort for professional development. Teacher A had a belief that the objective of environmental education should focus on the affective domain. A prerequisite to achieving this objective, according to her, was an awareness of environmental problems. Accordingly, she designed the curriculum and content in a way that raised the awareness level of students.

The subject matter, therefore, centered, on ecological knowledge. The teacher seemed to design the lesson to make the students aware of environmental issues based on their ecological knowledge. The content was to develop environmental sensitivity and literacy. In the actual classroom teaching, the teacher showed pictures of naturalized plants and animals or videotapes that revealed the importance of the foreshore.

The strength of Teacher A, therefore, was found in this aspect of the teaching method. She prepared the teaching materials from TV documentary footage and the Internet. She organized her instruction to help the students feel and think about environmental issues through indirect experience

from the visual materials.

Although Teacher A emphasized, during the interview, the importance of experiential learning in environmental education, she did not incorporate experiential learning in her classes. She said that she tries to enhance the students' environmental sensitivity and understanding by leading them outdoors to help the students identify themselves with the trees that they draw and to compare their own lives and the trees' in order to feel affection for the trees. In her classroom, however, she did not use a variety of methods, but focused more on ecological knowledge. She also acknowledged the importance of integrative teaching during the interview; however, her class dealing with the theme of environment did not integrate her learning with various subjects.

2) Teacher B's Classes

For the main stage of Cho (2001) five stage model, Teacher B facilitated the students' participation and understanding of the content by adopting a variety of teaching methods. During the first observation period, the teacher taught the food chain and the ecological components through an ecosystem game. She also helped students understand the interaction of the humans and the environment, using bonus cards to illustrate that the human beings can exert both good and bad influences on the ecosystem. In this stage, she not only provided the fun of the game but also helped the students to think about the importance of the food chain and ecological components, as well as the impact of the humans on the ecosystem.

During the second observation period, she introduced the case of bioaccumulation on the island of Borneo, before she explained the content of the textbook. Using the worksheets, she had the students understand that bioaccumulation that happened in Borneo, and that eventually victimized the humans. The activity taught students not only about bioaccumulation in Borneo but also how the ecological equilibrium can be disturbed by the humans. The students could feel the significance of environmental issues caused by human activities. Therefore, the strength of Teacher B was that she developed a variety of teaching methods to suit the lesson content and used them.

For the "curriculum and content aspect" of the KICE model, Teacher B provided the students with various and interesting materials by reorganizing the content of the textbook, rather than simply arranging the content along the curriculum and textbook units. For example, in teaching the unit on bioaccumulation, she first introduced the case of bioaccumulation in Borneo in order to help the students understand the meaning of bioaccumulation. Then she discussed the related concepts from the textbook.

Teacher B took environmental sensitivity and environmental understanding into consideration when selecting the lesson topics. In the classroom, she introduced the Mad Hatter's Disease that broke out on the island of Minamata, Japan, as an example of the humans suffering from the environmental problems, in order to help students see the seriousness of environmental problems. She also tried to teach the class with the theme of the environment through an integrative approach. For example, she discussed the locations, weather, and climate of Borneo in comparison with those of Korea before she brought up bioaccumulation on the island. In other words, she taught the geography (social science) of Borneo first before teaching the environmental issues. This approach made the students interested in the lesson content and the environmental problems from a wider perspective.

In terms of the "teaching method aspect", Teacher B was very resourceful, as she used a variety

of teaching methods such as games, worksheets, and experiential activities. She made this point clear in her interview. She said that she tries to enhance the students' environmental understanding by taking them outdoors to help them identify themselves with the trees by drawing detailed pictures of them in order for them to feel affection for the trees. In order to enhance environmental sensitivity, she usually had outdoor play activities or showed videotapes so that the students could feel connected with environmental problems. For example, the teacher played a horse- riding game to teach the students about water pollution. She compared the "horse" with the river and the "rider" with the pollutant, saying that the river feels pain if the pollutant is thrown into it just as the horse feels pain if the riders jump on to it.

Teacher B was developing her professionalism by attending various meetings and activities, such as "Teachers Who Love the Environment" and "The Online Cafe of the Environment and the Teachers". Compared with the other observed teacher, Teacher B understood the integrative approach well and tried to employ the approach in classroom teaching. Notwithstanding such an effort, she confessed, during the interview, that she feels difficulty with the integrative approach to environmental education. In order to ease this difficulty, she suggested that in-service training for environmental subjects is urgently needed. In particular, she claimed that opportunities for teachers to explore teacher-learning strategies through an integrative approach could enable teachers to learn more about integrating environmental education and adopting it in the classroom. She also said that an in-service camp, even for only a short time, for the teachers to actually demonstrate and exchange ideas regarding integrative methods would enhance the teachers' professionalism.

The two teachers described so far both demonstrated their efforts to emphasize environmental sensitivity in their classroom teaching. Hungerford (2002) explained that "environmental sensitivity", as a view point, sympathizes with the environment, environmental problems and issues, the ecological equilibrium, and promotes the peaceful coexistence of the humans and nature. Considering that the ultimate goal of school education on the environment is to cultivate environmental literacy and help students make responsible decisions and engage in citizen actions, the two teachers did not treat this goal importantly enough in the classroom. Gayford (2002) explained "environmental literacy" as the motivating process to utilize critical thinking, problem solving, and effective decision making in order for an individual to act on environmental issues.

Education for a sustainable future has emerged as a new paradigm of environmental education that can redefine the viewpoint of the environment and sustain the quality of our living. However, this aspect was not emphasized enough in the classroom teaching of the two teachers.

Ⅳ. Conclusion and Suggestions

The present study examined environment teachers' professionalism in teaching environmental subjects in order to improve in-service training programs for teachers. This study involved 249 middle school teachers and 182 high school teachers, and investigated their professionalism in relation to environmental education through a questionnaire survey. Two middle school teachers' classrooms were analyzed to see how their professionalism was manifested. In addition, they were interviewed in order to find out their philosophy regarding environmental education and their points of focus in environmental education. The teachers' self-reported professionalism and their actual level

of professionalism revealed through their classroom teaching and interview were compared.

The results showed that the secondary school teachers generally rated their professionalism to be in the middle of the five-point scale, which shows that the teachers were not very confident. The classroom observations revealed that the two teachers did not touch upon enough some aspects of environmental education. Those aspects were: (1) analyzing environmentally sustainable development and applying ecological knowledge to understand ecological principles, (2) clarifying the diverse viewpoints of value regarding environmental issues and personal values regarding decision making, (3) confirming, evaluating, and clarifying one's position concerning environmental issues and solutions, and (4) adopting the citizen action skills to find solutions to environmental issues and promote sustainable development.

The two teachers noted that, since the teacher training and retraining in college did not provide the necessary training enough, they had difficulty in developing materials and teaching environmental subjects that are characterized by interdisciplinary and practical applications. They also noted that environmental subjects often conflicted with other mandated courses. Their views seemed to represent the majority of opinions with regard to the apprehension of teachers to provide environmental education. These results imply that programs for teachers should be more integrative so that the teachers can be equipped with holistic approaches and that more time and resources should be provided for environmental education in secondary schools. McKeown-Ice (2000) found from her survey research on pre-service teachers' education programs that the two main factors influencing environmental education components were faculty interest or knowledge and state certification guidelines. She also revealed that the main barrier in environmental education at their pre-service level was limited course time conflicting with mandated course contents, which this study also found.

Suggestions drawn from of this study are as follows:

First, teacher retraining programs that enhance the teachers' professionalism in environmental education should be developed and provided. In particular, programs which can strengthen the abilities such as 'the abilities to communicate and apply ecological concepts', 'the ability to clarify the roles of different value systems for environmental issues and personal values in decision making', 'the ability to apply citizen action skills for solving environmental issues and for sustainable development' should be well prepared since teacher class observation revealed that there are gaps between these abilities. Future in-service training programs should include the latest theories of environmental education and teaching methods that incorporate the theories in the classroom. It is suggested that more than 70% of the in-service training program curriculum be allotted for the latest theories regarding the sustainable future and environmental education, and for actual teaching methods that incorporate these theories. A teacher training program operating system should be provided as well to provide these programs more efficiently.

Second, in order to promote locally meaningful environmental education, it is desirable that local experts of environmental education be invited as lecturers to the in-service training programs and that, rather than theory-based lectures, the teachers actually participate in the regional programs and outdoor field work.

Third, as in-service training programs attract teachers from diverse backgrounds, it would be meaningful to let the teachers share their information and communicate with each other. The pro-

gram could stimulate the teachers by training teachers of different genders, regions, majors, and school levels, as well as those with unusual passion and enthusiasm.

Fourth, courses pertaining to the methods of environmental education should properly include all of the five levels of ability proposed by Hungerford *et al*. (1994).

This study also suggests that environmental subjects should be treated as one of the main subjects rather than a peripheral subject. In this light, more time and educational resources should be provided for the environmental subjects at the secondary school level. Further research should be conducted to provide more data in improving environmental education programs.

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