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Author(s)	Matsuda, Kaori; Karchiganova, Zhanna; Nakamura, Osamu
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# Survey on Environmental Consciousness / Behavior Changes observed in Students of Kunimi High School, through the Introduction of Environmental Management System (EMS)

Kaori MATSUDA\* · Zhanna KARCHIGANOVA\*\* · Osamu NAKAMURA\*\*\*

## Abstract

Introduction of environmental management system in Japanese high schools were progressing from the late 1990s. In present paper we focused in simplified environmental management system, which has been successful in reduction of energy costs. Present paper shows that the effect of environmental management system operation in high school can bring to students environmental attitudes and considerations. After conducting two surveys and comparing them, we studied changes in behavior of students with operation of Kunimi High School EMS methods. The results pointed out that, there are two impacts on the students environment-conscious behavior, one is from environmental manager and committee members of Kunimi High School, and the other impact is from outside media. The results of survey showed that despite of its simplicity, the EMS which is being operated in Kunimi high school is found more effective than the other EMS which are being operated in other schools.

**Keywords** : Simplified Environmental Management System, Environmental Education, Environment-conscious Behavior

## 1. INTRODUCTION

The research topic of our laboratory concerned with expansion of EMS within educational institutions, where the execution of EMS ISO1400 is not progressed compared to other organizations. Nagasaki Prefectural Kunimi high school (hereinafter Kunimi High School) introduced own environmental management system (EMS) and it is being operated for eight years.

Kunimi high school has own EMS as well as own management techniques which is more convenient to high school structure. After the introduction of present EMS it became possible to reduce significantly the garbage quantity, usage of paper and fuel (2009a, Matsuda *et al*). We arranged the “important points” (The important points, which are required during preparation and execution EMS in organization, such as high school) which have been revealed during analysis of Kunimi High School case study. On the basis of these “important points” we conducted hearing interview surveys of other public high schools which have introduced EMS also.

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\*Fujitsu Limited

\*\*Waseda University Graduate School of Social Sciences

\*\*\*University of Nagasaki Graduate School of Fishers Science and Environmental Studies

(1)Simplified EMS. Simplification of EMS, elimination of points which are not necessary for high schools. (Please refer to other papers) It is possible to train high school students and pay more attention to environmental education with the simplification of EMS, because the system without simplification is difficult to introduce and moreover difficult to maintain in organization like high school.

(2) The order and structure of EMS should be incorporated and fit into the organization structure

(3) EMS organization members should include students

(4)Environmental education for the educational institutions

(5)Spread of common knowledge on environmental measures and education activities targeted to all students and teachers

(6)Hand over between the students and teachers

(7)Training of student and teacher members to operate the EMS, acquisition of knowledge and techniques

(8)Information exchange between students and teachers who are not EMS operation members

The result of present survey showed that these eight “important points” are common for any high school and necessary for introduction of EMS in educational institutions.

The table represent the results of a detailed analysis. As can be seen from the Table 1, Kunimi high school EMS has succeeded

in significant reduction of paper work, also reduced utility costs (2009b, Matsuda *et al.*)

The purposes of present paper were to clarify the effects of EMS operated in Kunimi high school, and to identify the changes in green attitudes and environmental considerations between students, for these purposes we conducted the questionnaire surveys.

## 2. SURVEY METHODS

This section examines the surveys which were conducted in May 2009 and February 2010. With separation of survey periods it is possible to compare the changes in consciousness and behavior of students before and after the environmental education programs. All students in Kunimi high school were

Table1 Result of survey for EMS that are introduced in high schools

	Activity	Items to be executed	a	b	c	d	e	Kunimi	
1	Simplified EMS	Simplification of Env. Management system	△※1	○	—	—	—	○	
2	EMS structure to be incorpo. into the	Incorporate EMS nto the organization structure	○	○	○	○	○	○	
3	EMS members should include students	Teacher	○	○	—	○	○	○	
		Student	△※2	○	—	△※3	—	○	
4	Environmental education	Execution of environmental education	○	○	○	○	○	○	
		Low energy and low resource in school	○	○	○	○	○	○	
		Environmental friendly activities in and outside school	—	—	—	—	○	○	
5	To arrange environment in school for getting information on environmental measures and education activities targeted to all students, teachers	To teachers	Explanation of environmental course at employee, teachers meeting in the beginning of year for informative purpose	—	—	—	○	—	○
			Explanation of environmental target at employee, teachers meeting in the beginning of year	○	○	○	—	—	○
			Explanation of planned practices at employee, teachers meeting at the beginning of year	—	—	○	○	○	○
			Make intermediate report at employee,teachers meeting in the middle of year	○	—	○	—	○	○
			Explanation of environmental activities to newcomer teacher	—	—	○	○	○	○
			Make final report at employee, teachers meeting in the end of year	—	○	—	—	—	○
			Setting own environmental goals	—	—	○	—	—	—
			Preparations of original methodical papers by teachers	—	—	—	—	○	—
		To students	Reports on energy consumption (periodically)	○	—	○	○	○	○
			Explanations on env. activities during opening ceremony or at meeting of students committee	—	○	—	○	○	○
			Explanations to each grade at home room	—	○	—	—	○	—
			Talking eniron. matter or give information every morning during homeroom talks.	—	—	○	—	—	—
			Announcements inside school during lunch time	○	—	—	—	—	—
			Lectures on environmental education to all students	○	—	○	○	○	○
6	Between teachers	Data transfer	○	—	○	○	—	○	
		Preparation of manuals	—	—	○	—	○	○	
		To hand over orally, verbally	○	—	○	○	—	○	
		To get training from the specialized teacher	○	○	○	—	○	○	
	Between students	To follow maintenance after the previous teacher	—	—	○	—	—	—	
		Data transfer	—	—	○	—	—	○	
		Preparation of manuals	—	—	○	—	—	—	
		To hand over orally, verbally	○	○	○	○	○	○	
7	To employees and teachers	To follow maintenance after the previous student	○	○	○	—	—	—	
		Participation to the lecture by attestatation register organ executed for the internal commission members	—	—	○	—	○	—	
		Participation to the lecture by attestatation register organ executed for the office workers	—	—	○	○	○	—	
	To students	Participation to the lecture by attestatation register organ executed for the teachers	—	—	○	—	○	—	
		To participate to outside lectures	—	—	—	—	—	○	
		To invite lecturing teachers from other places also	○	—	—	—	—	○	
8	Teachers	To open learning meetings inside school	○	—	—	—	—	—	
		Information exchange with other nearby elementary, middle and high schools	○	—	○	○	○	○	
	Students	Information exchange with other nearby elementary, middle and high schools	—	—	○	○	—	○	
		Environmental friendly activities inside the school, env. Protection activities	○	○	—	○	—	○	

questioned. Questionnaires were distributed during Home-Room classes and collected by the form teacher. The return was 100%. The classification of applicants and quantity of valid responses are shown in Table 2.

Questionnaires were consist of four parts. I - questions regarding environmental consciousness, II -questions regarding environmental behavior. III -questions regarding efforts at home. IV-questions regarding information sources on environmental issues.

The questions in I , II and III part of our questionnaires were arranged on the basis of Misaki's survey (Misaki,2005)and Hayabuchi's survey (Hayabuchi, 2007) . Hayabuchi has studied the effects of energy and environmental education to students. Misaki has researched the interest of students in energy issues, their knowledge in this field, decisions and actions of students. In the 4<sup>th</sup> part of questions we used the system of Hosaka's survey (2006, Hosaka et al). Hosaka has studied the source of information, where the students get information, knowledge about environmental issues. I. We asked in five- step rating scale (8 items) to know about environmental consciousness, the answers divided into "5, I think so very much(totally agree)", "4, I think so", "3, Neither agree nor disagree", "2, I do not think so", "1, I do not think so at all(totally disagree) versions. II-part,(8 items) questions about the environmental behavior and efforts ,III part, questions about the efforts at home(7 items) had choices as "5, I am used to do it", "4, I am used to do almost all of them", "3, It is hard for me choose if I am used to or not used to do it", "2, I am used to do very little.", "1, I am not used do it at all". IV-part, next, we asked in four- step rating scale, questions about the sources of information on environmental issues(10 items),and the choice answers were "4, use it often", "3,use it sometimes", "2 ,do not use it so much", "1 do not use it". In the end we asked social characteristic, grade, class, gender and if they belong or attend to environmental committee.

Table2 The classification of applicants and quantity of valid responses

Grade	May	February
1	129	120
2	111	108
3	128	110

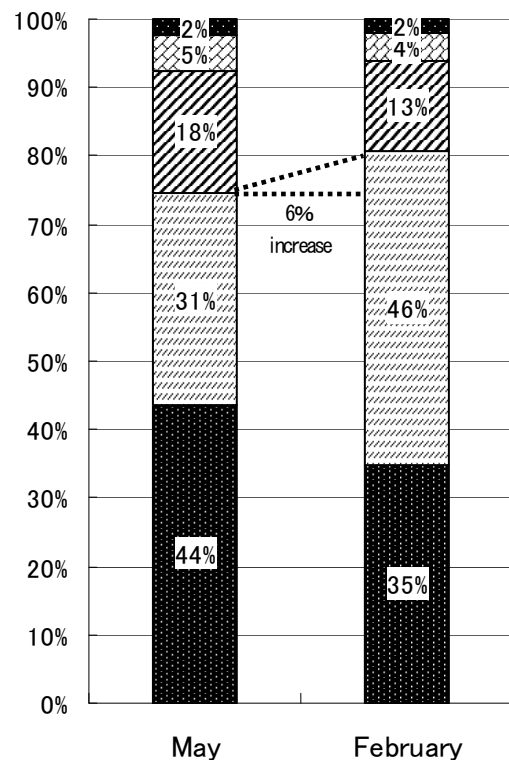
### 3. RESULTS

#### 3.1.FINAL RESULTS

##### (1)COMPARISON OF SURVEY RESULTS BEFORE AND AFTER EXECUTION OF ENVIRONMENTAL EDUCATION PROGRAM (ALL GRADES).

The Graph1 shows increase of answers"5, I think so very much(totally agree)" and "4, I think so' as an answers to the question "Do you think that it is necessary to turn off the lights on window side when it's sunny outside", increase for 6% showed the result of February 2010 survey in comparison to result of May 2009.

Similar to this result, we could see increase over 3 % on comparison of February and May results within the environmental consciousness item, for example: "I think it is necessary to turn off the lights on window side when it's sunny outside", "I think it is necessary to close the tap, in order to prevent water waste", "I think that the garbage should be



- I do not think so at all.
- ▨ I do not think so.
- ▩ Neither agr
- ▤ I think so.
- ▧ I think so very much.

Graph1 The question:There is a need to turn off the light on window side of the classroom.

separated', these 3 points showed more environmentally friendly results on 2<sup>nd</sup> survey. In the questions regarding the within school behavior and efforts, the items such as "I turn off the classroom lights during the lunch break", "I turn off the lights on window side of the classroom when it's sunny outside", "I close the tap", and "I utilize both sides of paper", these 4 efforts showed more environment-conscious results on second survey.

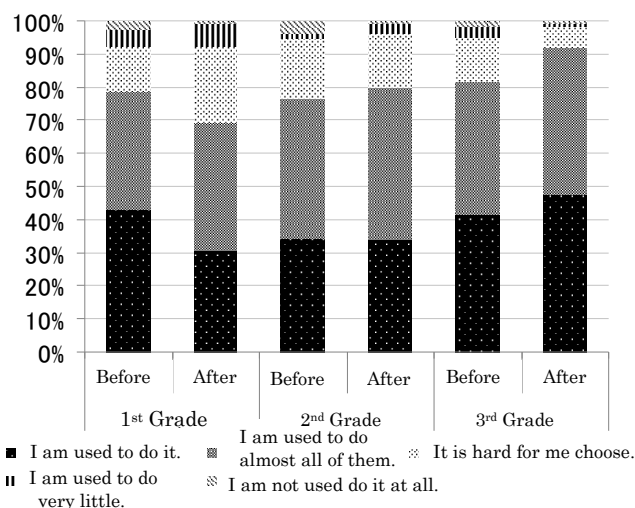
Overall, there could be seen a tendency that efforts in school increased more than environmental consciousness. In addition, scale of the efforts in the school showed higher results rather than consciousness.

### (2) COMPARISON OF SURVEY RESULTS BEFORE AND AFTER EXECUTION OF ENVIRONMENTAL EDUCATION PROGRAM (BETWEEN GRADES)

The results appeared interesting during comparison of survey results between the grades before and after the implementation of environmental education programs. First grade students were expected to show increase in environmental consciousness and behavior (efforts) inside school because of environmental education which is being exercised by usage of time for the integrated study curriculum during first year.

However, in the answers of first grade students in 13 of 16 items, the rate of "totally agree (I used to) and "I think so (I am used to do almost all of them)" choices showed the decrease.

On the other hand, among second and third grade students in



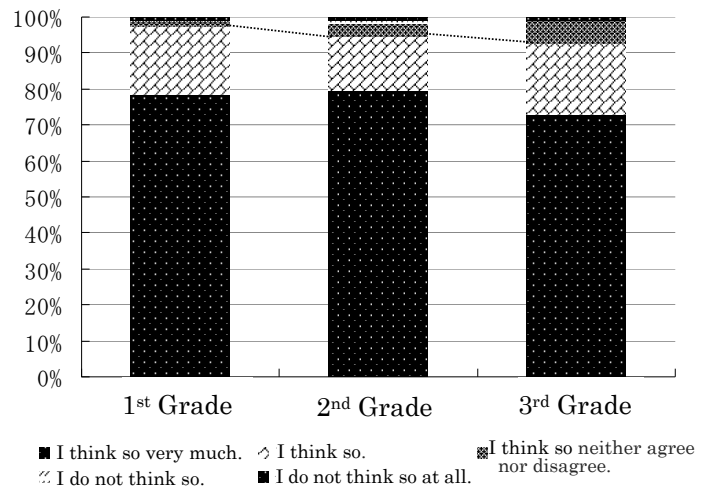
Graph2 "Turn off the empty classroom light" before and after the env. education

15 of 16 items, the rate of "totally agree (I am used to)" and "I think so (I am used to do almost all of them)" answers showed increase. This tendency is seen in school behaviors and efforts on items, such as "Turn off the empty classroom lights", see Graph2 From these factors we can see that the environmentally friendly behavior is being learned year by year.

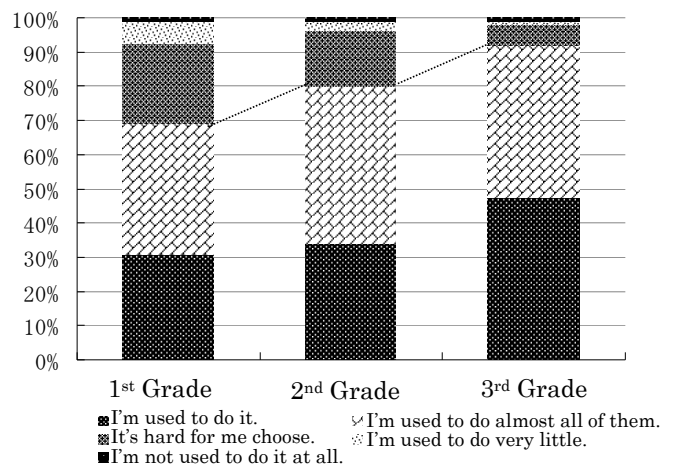
### (3) COMPARISON OF THE GRADES

Let's consider the results of the consciousness and the efforts comparison in the school and at home between the grades.

Graph3 shows the comparison of the consciousness on turning off the lights in the empty classrooms between the grades. Graph4 shows the comparison of the efforts (real activity) on turning off the lights in the empty classrooms between the grades. The results clearly indicate two points.



Graph3 Consciousness on turning off the light in the empty classrooms



Graph4 Comparison between grades on the efforts of turning the light off in the empty classrooms



First, as the grade goes up, the environmental consciousness has declined. Second, as the grade goes up, the environmental behavior has improved, so we can say that the number of students who have environmental friendly behavior increase as they go to upper grades.

### 3.2. STATISTICAL ANALYSIS

In this section, we analyze the relationship between behavior changes and outside information, for these purpose we conducted factor analysis on the questions regarding the information sources. After that, we conducted multiple regression analysis with the factors extracted, which we took as independent variable. The dependent variables were the environmental consciousness and efforts in school and at home.

#### (1) FACTOR ANALYSIS RESULTS

We conducted factor analysis (maximum likelihood method, Varimax method) for the items of environmental information sources, taking "Approach of Environmental Manager and Environmental Committee members" as 1<sup>st</sup> factor, and "Approach of media" as second factor. Statistic Table1 shows the results of analysis.

Statistic Table1 Factor analysis results

The information source for the environmental issues	Factor1	Factor2
environmental manager	<b>0.908</b>	0.227
student environmental manager	<b>0.892</b>	0.224
environmental committee member	<b>0.798</b>	0.27
environmental information	<b>0.764</b>	0.351
environmental newspaper	<b>0.749</b>	0.341
newspaper	0.172	<b>0.794</b>
Internet	0.259	<b>0.646</b>
Radio	0.28	<b>0.598</b>
Television	0.158	<b>0.51</b>
Determination	3.603	2.079
Coefficient of determination	40.029	23.102

Extraction method: Maximum likelihood method

Rotation method: Varimax method

Loading greater than 0,5 are in shown in bold.

#### (2) MULTIPLE REGRESSION ANALYSIS RESULTS

We conducted multiple regression analysis taking "Approach of Environmental Manager, Environmental Committee members" and "Approach of media" as independent variables and considered environmental

consciousness and efforts in school and at home as dependent variables (See Graph2).

The questions on "Approach of the Environmental Manager and Environmental Committee members" the school environmental effort "Take back plastic bottle with you" was the most significant in environmental consciousness and school effort items, the second significant result showed the effort "Turn off the lights on window side of the classroom when it's sunny outside". Regarding the "at home efforts" which showed significant results, they are: "Temperature settings of air conditioner during cold season" and the other is "Cooler temperature setting during hot season".

In contrast, the questions about "Approach of outside media" the item such as "Utilization of papers both sides" showed the most significant result, and the next item was "Garbage separation". "Utilization of papers both sides" and "Turning off the lights during lunch break" showed the most significant results in the "school efforts (behavior)". Within "The efforts at home "Eco bag usage for shopping" showed the most significant result, the next was "Utilization of papers both sides".

Some efforts showed much differences in coefficients. For example: "Take back plastic bottle with you" effort in questions regarding the environmental consciousness showed the difference in coefficient. "Turn off the lights in empty rooms", "Close the tap, to prevent water waste", "No smash of empty can bottles", "Take back plastic bottle with you" efforts showed more coefficient differences in questions regarding school efforts.

#### (3) ANALYSIS

The coefficient on "Approach of media" is higher than the coefficient of "Approach of the Environmental Manager and Environmental Committee" regarding the common environmental behaviors. The environment friendly behaviors such as "Turning off the light in the empty room", "Closing the tap, in order to prevent water waste", "Separation of garbage".

On the other hand, the coefficients on "Approach of the Environmental Manager and Environmental Committee" are higher than the coefficient of "Approach of media" regarding the Kunimi High School original environmental behaviors, which are being executed inside the school. For example: "take back with you the plastic bottles" or "no smash of empty can bottles". *Namely*, Kunimi Schools' original environmental efforts which are being taught at school are found effective from

Statistic Table 2 Multiple regression analysis result «Questions on environmental information»

Questions on environmental information	Environmental manager and committee member talks	Other media	R <sup>2</sup>
Empty room light off	0.112**	0.135***	0.031
Light off during lunch break	0.186***	0.156***	0.062
Window side light off on sunny day	0.229***	0.132***	0.073
Close the tap	0.074*	0.113**	0.017
Garbage separation	0.137***	0.159***	0.046
No smash can bottle	0.156***	0.141***	0.046
Take back plastic bottle	0.252***	0.091*	0.074
Paper both side usage	0.202***	0.166***	0.072

p<0.5\*, p<0.1\*\*, p<0.001\*\*\*

Attention) The value is standardized partial regression

Statistic Table 3 Multiple regression analysis result «the efforts at school»

The efforts at school	Environmental manager and committee member talks	Other media	R <sup>2</sup>
Empty room light off	0.054	0.111**	0.016
Light off during lunch break	0.118**	0.200***	0.059
Window side light off on sunny day	0.158***	0.100**	0.035
Close the tap	0.077*	0.139***	0.025
Garbage separation	0.074*	0.132***	0.022
No smash can bottle	0.152***	0.070	0.027
Take back plastic bottle	0.171***	0.057	0.032
Paper both side usage	0.143***	0.205***	0.065

p<0.5\*, p<0.1\*\*, p<0.001\*\*\*

Attention) The value is standardized partial regression coefficient

Statistic Table 4 Multiple regression analysis result «the efforts at home»

The efforts at school	Environmental manager and committee member talks	Other media	R <sup>2</sup>
Empty room light off	0.240***	0.154***	0.016
Light off during	0.279***	0.142***	0.059
Window side light off on sunny day	0.077*	0.131***	0.035
Close the tap	0.072	0.130**	0.025
Garbage separation	0.106**	0.173***	0.022
Usage of eco-bag for shopping	0.234***	0.251***	0.027
Paper both side usage	0.149***	0.259***	0.032

p<0.5\*, p<0.1\*\*, p<0.001\*\*\*

Attention) The value is standardized partial regression coefficient

the quantitative data.

Regarding the environmental efforts at home, it is clear that overall "influence of media" is greater. Environmental Managers and Environmental committee students are talking about resource and energy saving activities at school actively, and they conduct general check up if the other students do the same at school. But they can not make direct influence on their behaviors at home. Here, we can see important point, when we look at "at home efforts" in details "Setting air conditioner temperature during summer time to 28°C degree", "Setting heater temperature to 19°C degree during cold seasons", "Usage of eco-bag for shopping" or "Utilize both sides of paper", such kind of environmental friendly behaviors are not directly taught or told by Environmental Managers and Environmental committee students.

However, as can be seen in SPSS analysis, daily efforts done by Environmental Managers and Environmental committee members have similar or maybe greater influence than outside media recourses on "at home efforts". From these results we can say that efforts of Environmental Managers and Environmental committee members have influence on behaviors of students at home. Hayabuchi (2008) has examined ripple effect that leads to the action which oppose to the course content and long-term ripple effects. She reported that students actions were inspired by ripple effect, despite the fact that they were not covered in the class.

The effects of education could be seen within Kunimi school activities concerned with low resource and low energy life, also showed the results that these activities affect the behaviors of students outside of school also. Hayabuchi has stated that, not only the school education, but also the information which is being acknowledged in daily basis is also important for students, in order to get long-term ripple effect of environmental education. From the results of present survey, we suppose that both the "Approach of Kunimi original environmental education program" and "Approach of media" are the factors that train students to have more environmental friendly behaviors.

#### 4.CONCLUSION

We conducted the surveys on environmental consciousness and behavior of Kunimi High School students,

and examined the changes in students before and after the implementation of environmental education programs. Present study showed that the environmental consciousness decrease as the grade goes up, but at the same time environmental friendly behavior increases as the grade goes to upper grades. It can be said that environmental friendly behavior become a habit through each grade, students get used to it year after year, and there is possibility of acting without consciousness.

In addition, regarding the approach of "Environmental Managers and Environment Committee" in the school which can not make the direct influence to efforts at home on resource and energy savings, we found that, there is a possible effect of school efforts to efforts at home. These surveys showed that Environmental management system of Kunimi High School is effective as an environmental education which can give great success in resource and energy saving activities. The effects of the everyday efforts done by Environmental Managers could be confirmed also.

In present survey, we did not take into account the learning curriculum. We think that the research about long-term effect of environmental education programs with consideration of curriculum is subject to further studies.

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