Knowledge, attitude, and habits on solid waste management of students at Nho Quan C High School

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Kiến thức, thái độ, và thói quen về quản lý chất thải rắn của học sinh Trường THPT Nho Quan C, Ninh Bình

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ABSTRACT

Recently, along with climate change, solid waste management has become one of the environmental challenges that many developing countries, including Vietnam, are experiencing especially. Current status of knowledge and attitudes of high school students about solid waste management. For this reason, the research team conducted research on the current state of awareness, attitudes and habits of high school students at Nho Quan C High School, Ninh Binh province regarding solid waste management. In this study, we utilized an online questionnaire to conduct the survey of 800 high school students grading from 10 to 12. The data was then analyzed by the application of Statistical Package for Social Sciences (SPSS) software. The study results show that 390 graders (accounting for 48.8%) recognized empty plastic bottles and more than one third of the total participants identified food packaging, milk containers, and used napkins as common types of solid waste present within the school campus. The data also illustrates that there is a certain difference among participants in terms of grade levels. Specifically, the higher graders are, the more pro-environmental activities they conduct and involve, for example, while almost all students at grade 10 (95.6%) felt satisfied or very satisfied with the waste treatment methods being implemented in the school campus, only about 86% students at both grades 11 and 12 had the same evaluation. The research suggests that it is important and necessary to continue and enhance the implementation of environmental education and communication programs at high schools on solid waste and related management practices.

TÓM TẮT

Trong những năm gần đây, bên cạnh vấn đề biến đổi khí hậu, quản lý chất thải rắn đã trở thành một trong những thách thức môi trường nhiều nước đang phát triển, trong đó có Việt Nam đang gặp phải, đặc biệt là hiện trạng về kiến thức, thái độ của học sinh sinh trung học phổ thông về quản lý chất thải rắn. Đây là xuất phát để nhóm nghiên cứu thực hiện nghiên cứu nhằm đánh giá hiện trạng nhận thức, thái độ và thói quen của học sinh phổ thông trung học tại trường Trung học phổ thông Nho Quan C, tỉnh Ninh Bình về quản lý rác thải rắn. Trong nghiên cứu, chúng tôi đã sử dụng bộ câu hỏi trực tuyến dựa trên form để thực hiện khảo sát. Dữ liệu sau đó được phân tích bằng phần mềm SPSS 20. Tổng số 800 học sinh trung học phổ thông từ lớp 10 đến lớp 12 đã tham gia trả lời phỏng vấn. Nghiên cứu được thực hiện nhằm xác định thực trạng kiến thức, thái độ, và thói quen quản lý chất thải rắn của học sinh trung học phổ thông. Kết quả nghiên cứu cho thấy 390 học sinh các lớp (chiếm 48,8%) nhận biết chai nhựa rỗng và hơn 1/3 tổng số học sinh xác định bao bì thực phẩm, hộp đựng sữa, và khăn ăn đã qua sử dụng là những loại rác thải rắn phổ biến xuất hiện trong khuôn viên trường học. Kết quả cho thấy có sự khác biệt nhất định giữa những người tham gia về cấp độ. Cụ thể, học sinh lớp càng cao thì các hoạt động vì môi trường càng được thực hiện và tham gia nhiều hơn, chẳng hạn, trong khi hầu hết học sinh lớp 10 (95,6%) đều cảm thấy hài lòng hoặc rất hài lòng với các phương pháp xử lý rác thải đang được triển khai trong khuôn viên trường thì chỉ có khoảng 86% học sinh cả lớp 11 và lớp 12 có đánh giá giống nhau. Nghiên cứu cũng cho thấy việc tiếp tục và tăng cường thực hiện các chương trình giáo dục, truyền thông môi trường ở các trường trung học về chất thải rắn và các thực hành quản lý liên quan là rất quan trọng và cần thiết.

1. INTRODUCTION

The total quantity of solid waste collected worldwide is about 11.2 billion tons [1]. Among different sources of this type of waste, municipal origin contributes a significant proportion, accounting for over 2 billion tones in 2016 and expected to increase to 3.40 billion tons in 2050. Particularly, at least 33 percent of total municipal waste was not managed in an environmentally friendly manner [2]. Improper disposal and failure in other solid waste management activities can result in various health risks from disease, contamination of ground and surface water, and the release of powerful greenhouse gases such as methane. About 90% of plastics in the ocean comes from just 12 rivers that are all located alongside large human populations with poor waste management systems (Oceansplasticleanup) [3]. From this situation, improving waste management in general, and solid waste management in particular is an immediately urgent request. Solid waste management is a set of activities starting from generation to collection, transport, treatment, and disposal of waste. To enhance this sector, raising awareness and communicating on behavior change among consumers and health impacts from harmful waste exposure, especially in children, have been chosen as one of different measures suggested by WHO [4].

Since 1892, Patrick Geddes had pointed out the important interrelation between the quality of the environment and that of education. He was also a pioneering teacher in providing opportunities for learners to interact with the surrounding environment. However, until after the Earth Summit held in Rio de Janeiro from June 3 to June 14, 1992, there was a consensus among nations on the perspective that striving to achieve sustainable development is, in essence, a learning process [5]. Since then, environmental education and communication have become indispensable tools in raising awareness, increasing interest, and changing behaviors in environmental management in general and in solid waste management in particular. In addition, several studies and research approaches have been conducted and exploited to further confirm the close link among environmental knowledge, attitudes, and behaviors. Particularly, a large number of researches mainly focused on the environmental knowledge, attitudes and behaviors of school or college students [6-8].

In recent years, researchers focusing on this interrelation have increasingly utilized statistical methods, especially a variety of test and modelling. In a study of Sevencan et al. [9], a questionnaire consisting of 58 questions and 17 statements and the t test were utilized to determine environmental consciousness of students from secondary and high schools in Bodrum (Turkey). Applying the same approach, Msengi and Doe [10] used a questionnaire including 35 questions from the Centers for Diseases Control and the ANOVA test to evaluate the knowledge, attitude, and behavior on environmental health among high school students, and to check the knowledge differences among school locations. Results from these studies all suggested that environmental intervention or training activities are necessary to improve the environmental awareness of school students. With regard to the specific field of solid waste, Desa et al. [11] used a self-administered questionnaire and the Statistical Package for Social Science (SPSS) software was used to assess students' knowledge, attitudes, awareness and practices towards the solid waste problem. Raghu and Rodrigues [12] also employed a self-administered questionnaire method and structural equation modeling to test the statistical significance of the model integrating environmental knowledge and situational factors into the theories of planned behavior and value belief norm. The main findings of this research show that intention, subjective norms, perceived behavioral control and attitude had a significant positive influence on behavior. More recently, various studies have focused on the knowledge, attitude, and perception of students on solid waste management towards a more circular economy [13, 14]. These studies also applied a three-section questionnaire and the descriptive and analytical statistics of the data collected.

In Vietnam, in recent years, a significant number of study has been conducted to investigate the factors influencing the intention of residential households or students on solid

waste separation at sources [15-18]. However, researches on the interrelation among knowledge, attitude, and behavior of school students on solid waste management are still limited. Particularly, the use of statistical tools to identify the differences among different graders on this topic is necessary. This article was conducted to evaluate the knowledge, habits and attitudes of high school students with a focus on the differences between grades on solid waste management at Nho Quan C high school, Ninh Binh province. The results of the article will serve as a theoretical and practical basis to propose appropriate environmental education and communication programs for students at different educational levels.

2. RESEARCH METHODOLOGY

Adopting the theory of planned behavior [12], the research team suggested that knowledge on solid waste management would positively influence on the attitude and behavior of individuals. Therefore, the study aimed at assessing high school students' knowledge, attitudes, and behavior on solid waste management at the selected school. Prior to the study, the research was approved by the administration board of the school. The students were informed and explained on the objectives of the study and agreed to participate in the survey. These participants answered the questionnaire independently by using their own computers or smartphones.

2.1. Designing the questionnaire

The questionnaire items were partly adapted from a previously published article [19] and the remaining was developed for the specific purpose of this study using Google Forms. The investigating information is divided into two main parts namely General information and Survey content. In the first part of the questionnaire, participants are asked to provide personal information such as name, gender, ethnicity, class, school, and address. In the second part, study contents are classified into three sub-categories of knowledge, attitudes, and behaviors related to solid waste and solid waste management. In the questionnaire, there are two types of questions including closed questions and multiple choice questions. The first part consists of multiple choice questions. In addition, in some questions of this section, students are also able to supplement their response if necessary. The following parts are questions using the Likert scale which contains five response options indicating how much they agree or disagree with the question/statement. The choices range from Strongly Agree/Strongly important/Strong satisfactory/Strong necessary/Strong worried/Always to Strongly Disagree/Strongly unimportant/Strong dissatisfactory/Strong unnecessary/Strong unworried/Never in order to get a holistic view of students' opinions and their levels of agreement.

2.2. Data collection

With the coordination of the management board of Nho Quan C high school, the study collected data by sending designed and tested questionnaires to students in all three (03) grades (10, 11, 12) of the school. Data was primarily processed to remove invalid answers. After refining the results, a total of 800 valid survey questionnaires were used for analysis.

2.3. Data Analysis

The questionnaires were coded and items were entered into the SPSS software. Participants' scores on Part I (knowledge), Part II (attitudes), and Part III (habits) were computed. The data in the first part were used as variables to analyze similarities and differences between groups of subjects. With response results from 800 students, the data acquired for the remaining parts is huge and the research group decided to focus the analysis on the differences among graders from 10 to 12.

2.3.1. Reliability Statistics

The study used Cronbach' Alpha α (or coefficient alpha) to check the internal consistency (Reliability) for two sets of questions on awareness and attitude of high school students on solid waste problems and students' solid waste management habits. Cronbach' Alpha is expressed as a number between 0 and 1 with higher values indicating higher internal consistency. Cronbach's alpha reliability scale [20] is provided in Table 1.

Table 1. Cronbach's Alpha Level of Reliability

Cronbach's Alpha Score	Level of Reliability
0.0 – 0.20	Less Reliable
>0.20 – 0.40	Rather Reliable
>0.40 – 0.60	Quite Reliable
>0.60 – 0.80	Reliable
>0.80 – 1.00	Very Reliable

Cronbach's Alpha scale was used to test reliability. This coefficient allows testing whether questions in the same group are reliable or not. Besides, this test must also reflect the degree of correlation between variables (questions) in the same factor group. In addition, the correlation between each observed variable with the remaining variables in the scale was checked by the utilization of Corrected Item – Total Correlation indicator. According to Cristobal et al. [21], a good scale is when the observed variables have the Corrected Item - Total Correlation value from 0.3 or more. Therefore, when performing the Cronbach's Alpha reliability test, the observed variable has the Corrected Item - Total Correlation coefficient less than 0.3, it is necessary to consider removing that observed variable. The higher the Corrected Item - Total Correlation coefficient, the better the quality of the observed variable.

2.3.2. Independence test

Independence test is primarily used to examine whether two categorical variables (two dimensions of the contingency table) are independent in influencing the test statistic (values within the table). Aiming at examining the differences in answering the questionnaire of high school students in terms of grades, the study utilized **Chi – square Tests**. According to

this test, there are two theories namely H_o and H_1. In terms of theory H_o, the answers from students at different grades have insignificant differences or high consistency. By contrast, H_1 is applied for the differences or inconsistency among answers of students. If the result of Chi – square Tests (Sig. or alpha value) is less than 0.05, it is acceptable to reject the hypothesis H_o, which means that there is inconsistency in answering questions among students from different grades.

3. RESULTS AND DISCUSSION

3.1. Demographic information of the participants

The study conducted the survey at the School from September to October 2022. In the school year of 2021 – 2022, there were 1119 students in 28 classes of three grades from 10 to 12. The study received responses from 804 students, however, four (04) answers were invalid and then rejected from the final list.

The proportions of students from three grades of 10, 11, and 12 are relatively similar at 31.1%, 34.9%, and 34.0% respectively. There is information related to gender and ethnics, however, this study only concentrated on the differences among various graders with regarding to the knowledge, attitudes and behaviors on solid waste management.

Table 2. Demographic information

No. of order	Demographic Information		Number	Percentage
1	Grade	10	249	31.1
		11	279	34.9
		12	272	34.0
		Total	**800**	**100**
2	Gender	Females	478	59.8
		Males	322	40.2
		Total	**800**	**100**
3	Ethnicity	Kinh	706	88.3
		Muong	90	11.2
		Others (Tay, Nung)	4	0.5
		Total	**800**	**100**

3.2. Knowledge and understandings of students on solid waste and related environmental issues

To carry out this content, the study used seven multiple choice interviews for that purposes. Table 3 below summarized the results.

Table 3. Knowledge and understandings on solid waste and related environmental issues

Questions	Options	Answers	
		No	**%**
Q1.1: Common types of solid waste	Falling leaves and dead branches	498	62.3
	Empty plastic bottles	390	48.8
	Food packaging, milk containers, and used napkins	268	33.5
	Single – use plastic bags	243	30.4
	Wasted papers	207	26
	Others	37	4.6
Q1.2: Environmental – related incidents occurring within the school campus	Low quantity and sanitary levels of the public toilets	493	61.6
	Indiscriminate disposal of garbage	247	30.9
	Clearly increasing quantity and types of solid waste	172	21.5
Q1.3: Currently applied waste treatment methods	Burning rubbish outdoor	401	50
	Reuse and recycling	207	26
	Don't know	199	25
	Combusting waste by incinerators	111	14
	Composting	95	12
	Dumping in landfills	78	9.8
Q1.4: The most suitable waste treatment method(s) should be applied within the school campus	Recycling	510	63.8
	Composting	294	36.8
	Burning	200	25.0
	Dumping in landfills	131	16.4
	Dumping in spare space	125	15.6
Q1.5: Monetary fines for indiscriminate littering in the public places	Yes	690	86.3
	No	100	12.5
Q1.6: Monetary fines for waste burning in the public places	Yes	462	57.8
	No	304	38.0
Q1.7: Monetary fines for indiscriminate littering resulting in drainage blockage	Yes	685	85.6
	No	103	13

As can be seen from Table 3, in terms of types of solid waste, 498 surveyed students, accounting for about 62.3% of the total, chose falling leaves and dead branches as a sort of waste frequently occurring within the school campus, empty plastic bottles were selected by 390 (48.8%) graders, food packaging, milk containers, and used napkins were identified by 268 (33.5%) participants, single – use plastic bags, and wasted papers were the fourth and fifth kinds of waste determined by 243 (30.4%) and 207 (26 %) students respectively.

While solid waste is the most visible item that can be realized by students, low quantity and sanitary levels of the public toilets were the environmental issue that was recognized by more than half of surveyed students, accounting for 61.6%. Indiscriminate disposal, and clearly increasing quantity and types of solid waste were the second and third issues identified by 31% and 21.5% of the total participants.

For currently applied waste treatment methods within school campus, burning waste outdoors was identified by 50%, following by using and recycling were recognized by 26%. While 25% of the surveyed students had no idea on the solution to discarded items, combusting waste by incinerators, composting, and dumping in landfills were provided by 14%, 12% and 9.8% of the surveyed graders correspondingly. Particularly, according to 63.8% of participants, recycling was the most suitable method to be

applied at the school campus. Composting and burning were the second and third most appropriate practices chosen by 36.8% and 25% of the total respectively. However, the proportions of surveyed students choosing dumping in landfills and in spare space also stood at 16.4% and 15.6% accordingly.

With regard to monetary fines for some inappropriate practices to the environment, according to more than 85% of the total surveyed graders, people with indiscriminate littering in the public places or resulting in drainage blockage would be financially penalized. However, only about 58% of the total agreed that individuals burning waste in the public places would face some kinds of monetary fines.

While not all participants involving in the research had the same levels of knowledge on solid waste in general, and associated management practices, in particular, their answers have demonstrated that they have been taught or informed about these issues. However, they should be provided with more detailed information on the solid waste treatment methods, especially, the pros and cons of each option.

3.3. Awareness and attitudes of students on solid waste and solid waste management

Six questions in the form of a 5-options Linkert scale were used. The results of testing the reliability of 6 questions using Cronbach's Alpha coefficient showed a result of 0.662 in the range of > 0.60 - 0.80. Table 4 illustrates the results of reliability for statistical data on Part II.

Table 4. Results of Reliability Statistics for results of Part II

Cronbach's Alpha	N of Items
0.662	6

In the following step, the study used the Item-Total Statistics test results for six questions of Part II to identify which factors had little influence on the reliability.

Table 5. Item-Total Statistics for Part II of the Questionnaire

No.	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item -Total Correlation	Cronbach's Alpha if Item Deleted
Q2.1	15.21	5.238	.526	.570
Q2.2	15.26	5.196	.500	.578
Q2.3	14.84	5.649	.451	.601
Q2.4	**15.77**	**6.335**	**.170**	**.697**
Q2.5	15.27	6.062	.386	.625
Q2.6	15.34	5.399	.364	.634

From the data provided in Table 5, it can be said that question Q2.4 has the smallest Corrected Item-Total Correlation value (< 0.3).

In other words, this question needs to be eliminated when analyzing the other data.

Table 6. Answers of students on care about waste issues and littering methods

Answer	Question	Q2.1				Total
		Don't know	Not concerned	Concerned	Very concerned	
Total	Number	56	12	502	230	800
	Percentage	7.0	1.5	62.7	28.8	100.0

Answer	Question	Q2.2				Total
		Don't know	Not worried	Worried	Very worried	
Total	Number	61	38	481	220	800
	Percentage	7.6	4.8	60.1	27.5	100.0

Answer	Question	Q2.3				Total
		Don't know	Not important	Important	Very important	
Total	Number	26	14	297	463	800
	Percentage	3.2	1.8	37.1	57.9	100.0

The data from table 6 shows that, when being asked on waste problems and other related issues, around 90% of the total expressed their concern, and 8.5% and 12,8% of the surveyed

students have little knowledge or interest. In terms of littering methods, almost all students at three grades (95%) felt that this aspect is important or very important, and only 5% of them presented their ignorance.

Table 7. Levels of satisfaction with the waste treatment methods being implemented in the school campus

Grade		Question	Q2.5				Total
			Very unsatisfied	Unsatisfied	Satisfied	Very satisfied	
Grade	10	Number	3	8	183	55	249
		Percentage	1.2	3.2	73.5	22.1	100
	11	Number	7	30	192	50	279
		Percentage	2.5	10.8	68.8	17.9	100
	12	Number	10	28	176	58	272
		Percentage	3.7	10.3	64.7	21.3	100
Total		Number	20	66	551	163	800
		Percentage	2.5	8.2	68.9	20.4	100

The data provided in Table 7 reveals that while almost all students at grade 10 (95.6%) felt satisfied or very satisfied with the waste treatment methods being implemented in the school campus, about 86% students at both grades 11 and 12 had the same evaluation. By contrast, slightly more than 13% and 14% of 11th and 12th graders respectively felt very unsatisfied or unsatisfied in comparison to just about 4.4% of students at grade 10 that were dissatisfied with measures implemented at the school campus to handle solid waste.

Table 8. The necessity of monetary fines for improperly littering behaviors

Grade		Question	Q2.6				Total
			Don't know	Not necessary	Necessary	Very necessary	
Grade	10	Number	26	25	135	63	249
		Percentage	10.4	10.0	54.2	25.3	100
	11	Number	27	24	136	92	279
		Percentage	9.7	8.6	48.7	33.0	100
	12	Number	23	24	156	69	272
		Percentage	8.5	8.8	57.4	25.4	100
Total		Number	76	73	427	224	800
		Percentage	9.5	9.1	53.4	28.0	100

The analyzed results illustrated in Table 8 show that 20.4% of students at grade 10 had the answers of "don't know" or "not necessary" on the application of monetary fines for improperly littering behaviors. This figure is insignificantly higher than those for 11th and 12th graders standing at 18.3% and 17.3% respectively. Consequently, about 82% of students attending grades 11 and 12 agreed that it is necessary or very necessary to apply financial penalties for indiscriminately littering activities. A smaller proportion of 10th graders appreciated the application of this tool.

While the research results show the diverse perspectives of high school students at the study site on solid waste related issues, the majority of answers demonstrates their concern and awareness at a certain scale. There are a number of students illustrating their ignorance or disregard of surrounding waste problems.

In order to find similarities and differences between classes in high school, Chi – square Test was used. The results of Chi – square Test on awareness and attitudes of students at different grades about solid waste and solid waste management are summarized on Table 9.

Table 9. Results of Chi – square Test

No.	Question	Value	df	Asymp. Sig. (2-sided)	Conclusion
1	Q2.1	4.955	6	0.550	Similar
2	Q2.2	5.399	6	0.494	Similar
3	Q2.3	4.709	6	0.582	Similar
4	Q2.5	17.092	6	0.009	Different
5	Q2.6	6.640	6	0.0355	Different

The figure from table 9 indicates that the calculated values of Asymptotic Significance (2-sided) for the first three questions are higher than 0.05 and that of the last two queries are less than 0.05. In other words, while students at three grades were relatively similar in the levels of care and worry on waste issues as well as the assessment on importance of littering methods of students, they were different in assessing levels of satisfaction with the waste treatment methods being implemented in the school campus and necessity to penalize inappropriate waste disposal behaviors with money.

3.4. Habits of students at different grades on solid waste management

Similar to the analysis process for Part II, the study used Cronbach's Alpha to test Reliability of answers for Part III. The results of testing the reliability of 12 questions using Cronbach's Alpha coefficient showed a result of 0.73 in the range of $> 0.60 - 0.80$ of Reliable.

Table 10. Results of Reliability Statistics part II

Cronbach's Alpha	N of Items
0.73	12

To check which of the 12 questions used was not really related to the remaining questions, the study used the results of calculating Item-Total Statistics.

Table 11. Item-Total Statistics for Part III of the Questionnaire

No.	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q3.1	29.84	16.632	0.429	0.703
Q3.2	30.09	16.348	0.476	0.696
Q3.3	29.25	17.085	0.396	0.708
Q3.4	29.51	17.569	0.378	0.711
Q3.5	29.82	18.723	0.347	0.718
Q3.6	29.72	19.358	0.303	0.724
Q3.7	**29.09**	**18.866**	**0.124**	**0.743**
Q3.8	30.11	17.258	0.382	0.710
Q3.9	30.47	16.808	0.393	0.708
Q3.10	30.15	17.051	0.429	0.704
Q3.11	30.54	16.697	0.397	0.708
Q3.12	30.63	16.870	0.375	0.711

As can be seen in Table 11, the Corrected Item-Total Correlation coefficients for question 3.7 have the lowest values at 0.124< 0,3. Consequently, it is statistically necessary to remove questions Q3.7 from the questionnaire. The statistical results of the interview data of part III are given in the following sections.

Table 12. Results on some solid waste management habits of students at different grades

Question		Q3.1					Total
Answer		Never	Occasionally	Frequently	Always	Others	
Total	Number	25	287	306	176	6	800
	Percentage	3.1	35.9	38.2	22.0	0.8	100
Question		Q3.2					Total
Answer		Never	Occasionally	Frequently	Always	Others	
Total	Number	45	387	241	123	4	800
	Percentage	5.6%	48.4%	30.1%	15.4%	0.5%	100
Question		Q3.3					
Answer		Never	Occasionally	Frequently	Always	Others	Total
Total	Number	13	106	226	452	3	800
	Percentage	1.6	13.2	28.2	56.5	0.4	100
Question		Q3.4					
Answer		Not yet	Not sure	Partially changed	Completely changed	Others	Total
Total	Number	31	46	506	212	5	800
	Percentage	3.9	5.8	63.2	26.5	0.6	100

Answer \ Question		No	Not sure	Q3.5 Very willing to participate in	Others	**Total**
Total	Number	17	103	672	8	17
	Percentage	2.1	12.9	84.0	1.0	2.1

Answer \ Question		Not yet	Not sure	Q3.6 Used to participate in	Others	**Total**
Total	Number	12	26	760	2	800
	Percentage	1.5	3.2	95.0	0.2	100

Answer \ Question		Not yet	Not sure	Q3.11 Used to	Others	**Total**
Total	Number	259	193	347	1	800
	Percentage	32.4	24.1	43.4	0.1	100

Statistic analysis results provided in Table 12 show that more than half of the total number of surveyed students accounting for 60.2% frequently or always prioritize more environmentally friendly products. Nevertheless, only about 45% of total usually or consistently decide to reuse or recycle used items instead of throwing them into rubbish bins. In particular, nearly 6% of these students have never thought about these alternatives and around 50% of total only occasionally try to use the old items one more time. When being asked about developing environmental protection regulation at school levels, approximately 85% of the total number of interviewees express their special concern and support. In terms of waste reduction, especially plastic waste, virtually 90% of surveyed students have changed partially or completely their consumption habits in order to lower the quantity of waste generated. While only 84% of surveyed students said that they are very willing to participate in clean-up activities in the school campus or adjacent living places, 95% of these students used to take part in this type of environmental movement. Twelve surveyed students consisting of 1.5% of the total have not joined any group works related to environmental sanitation. Particularly, more than half of studied students have not been involved in or not been sure about opposing to burning waste outdoors. About 43% of those participating in the survey used to present their disagreement about public combustion of solid waste.

Table 13. Participating in environmental protection communication programs

Grade \ Question			Q3.8 Not yet	Not sure	Used to participate	Others	**Total**
Grade	10	Number	37	59	151	2	249
		Percentage	14.9	23.7	60.6	0.8	100
	11	Number	45	43	188	3	279
		Percentage	16.1	15.4	67.4	1.1	100
	12	Number	36	34	202	0	272
		Percentage	13.2	12.5	74.3	0.0	100
Total		Number	118	136	541	5	800
		Percentage	14.8	17.0	67.6	0.6	100
			Q3.9				
Grade	10	Number	92	75	80	2	249
		Percentage	36.9	30.1	32.1	0.8	100
	11	Number	60	80	138	1	279
		Percentage	21.5	28.7	49.5	0.4	100
	12	Number	72	54	146	0	272
		Percentage	26.5	19.9	53.7	0.0	100
Total		Number	224	209	364	3	800
		Percentage	28.0	26.1	45.5	0.4	100

It is obvious to see from Table 13 that the percentages of 12th graders participating in some environmental protection communication programs are significantly higher than those of 10th and 11th graders. Specifically, among the surveyed students attending the last grade of high school, 74.3% of them used to take part in some lectures or talks on issues related to waste or environment, and 53.7% used to join in a meeting on or sign a commitment to protect the environment. On the opposite side, the proportions of students attending grade 10 that have not been engaging in any types of those activities are higher than those of students attending the remaining grades, and make up 14.9% and 36.9% of the total respectively. The figures provided in Table 13 also show that less than half of the total number of surveyed students have taken part in signing environmental protection commitments. In other words, events organized for students to get involved in such activities have not been popular in this school.

Table 14. Effort or material contribution to environmental protection organizations

Grade		Question	Q3.10				Total
			Not yet	Not sure	Used to participate	Others	
Grade	10	Number	50	70	127	2	249
		Percentage	20.1	28.1	51.0	0.8	100
	11	Number	36	46	197	0	279
		Percentage	12.9	16.5	70.6	0.0	100
	12	Number	35	37	200	0	272
		Percentage	12.9	13.6	73.5	0.0	100
Total		Number	121	153	524	2	800
		Percentage	15.1	19.1	65.5	0.2	100

As can be seen from Table 14, while the majority of 11th and 12th graders used to contribute to some extent to environmental protection organizations, only about 50% of those attending 10th class have done the same things.

Table 15. Opposing to dumping waste on landfills

Grade		Question	Q3.12				Total
			Not yet	Not sure	Used to participate	Others	
Grade	10	Number	89	75	83	2	249
		Percentage	35.7	30.1	33.3	0.8	100
	11	Number	114	66	99	0	279
		Percentage	40.9	23.7	35.5	0.0	100
	12	Number	79	77	115	1	272
		Percentage	29.0	28.3	42.3	0.4	100.0
Total		Number	282	218	297	3	800
		Percentage	35.2	27.2	37.1	0.4	100

In terms of dumping waste on landfills, more than half of surveyed students at grades 10 and 11 were not sure or not opposed to this solution, accounting for nearly 66% and 64% of the total, respectively. Therefore, only about one third of them presented their disagreement on this type of waste treatment. For 12th graders, the proportion of students who argued the utilization of this waste disposal is significantly higher, standing at about 42%.

In general, in addition to the information on the knowledge and attitudes, the results studying on the habits of surveyed students on solid waste management have confirmed that the higher graders are, the more pro-environmental activities they conduct and involve. Especially, it is necessary to create more opportunities for 10th students to

participate in environmental communication programs and activities. The updated information related to solid waste management practices also should be disseminated effectively to high school students. To check the homogeneity of the answers in part III for different grades, the Chi-square test was used.

Table 16. Results of Chi – square Test for answers of students

No.	Question	Value	df	Asymp. Sig. (2-sided)	Conclusion
1	Q3.1	11.020	8	0.201	Similar
2	Q3.2	5.477	8	0.706	Similar
3	Q3.3	2.307	8	0.97	Similar
4	Q3.4	13.631	8	0.092	Similar
5	Q3.5	4.81	6	0.568	Similar
6	Q3.6	7.468	6	0.28	Similar
7	Q3.8	17.306	6	**0.008**	**Different**
8	Q3.9	34.845	6	**0.000**	**Different**
9	Q3.10	37.941	6	**0.000**	**Different**
10	Q3.11	6.922	6	0.328	Similar
11	Q3.12	13.045	6	**0.042**	**Different**

It is obvious from Table 16 that the calculated values of Asymptotic Significance (2-sided) for the first six questions and question Q3.11 are higher than 0.05 and that of the questions Q3.8, Q3.9, Q3.10, and Q3.12 are less than 0.05. In other words, students at three grades were analogous in expressing their habits related to waste management such as using products that are more environmentally friendly, reusing or recycling before throwing used items, supporting the development process of environmental protection regulations in the schools, changing their habits toward waste reduction generated in the school campus, willing to participate in clean-up activities in the school campus or adjacent living places, participating in clean-up activities in the school campus or adjacent living places, and opposing to burning waste outdoor. However, they were relatively divergent in some customs such as participation in environmental protection communication programs, effort or material contribution to environmental protection organizations, and opposition to dumping waste on landfills.

4. CONCLUSSION

In terms of knowledge on solid waste, surveyed students identified the main types of solid waste as including broken leaves and twigs (62.3%), followed by plastic bottles (48.8%), and the rest were other types of solid waste such as plastic bags and paper,... Most participants (90%) agreed that this type of waste is one of the environmental problems occurring within their school campus. However, there is still a proportion of surveyed graders who are not really concerned about the measures that their school is applying to deal with solid waste. Half of the participated students chose burning waste outdoors as the treatment method and one quarter of them had no idea on the solution to discarded items.

Although the research results show a wide range of views of high school students at the study site on solid waste related issues, the majority of answers demonstrates their concern and awareness at a certain scale. However, there is still a proportion of surveyed students illustrating their ignorance or disregard of surrounding waste problems. Test results using the Chi – square standard shows that for questions 2.1 to 2.3 there is no difference between grades, on the contrary for questions 2.5 and 2.6 there is a clear difference between grades, grade 10 seems to be not really paying attention to the issue of waste treatment and penalties for improperly littering behaviors. A similar trend is also seen with students' solid waste management habits. The results of checking the consistency in questions from 3.1 to 3.12 showed that the majority of questions had the same answers, with only 4 questions, 3.8, 3.9, 3.10, and 3.12 gave different results between grades.

From the above results it can be seen, there is a close relation among knowledge, attitude, and practices of students on environmental problems. This linkage has been reconfirmed with the results on the habits of surveyed students about solid waste management practices. It is obvious that the higher graders are, the more pro-environmental activities they conduct and involve.

In general, the study results raise the importance and necessity to enhance the environmental education and communication at high school on solid waste and related management practices. However, the approach should be flexible and based on the current status of each grader.

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