

**Design and evaluation of solid waste management
courses for sustainable development in elementary
schools: A case study in Da Nang city, Vietnam.**

A Thesis for Acquirement of the Degree of Doctor of Philosophy

Course of Environment and Resources Systems
Graduate Programs in Environmental Systems
Graduate School of Environmental Engineering
The University of Kitakyushu, Japan

By

Phan Hoang Thu Thao

Supervisor: Professor Takaaki Kato

Kitakyushu, Japan, June 2020

ABSTRACT

Environmental problems are of concern to citizens and governments of both developed and developing countries. To solve existing and emerging environmental problems, education is important. This study aimed to design solid waste management courses for elementary school students in Da Nang city, Vietnam, and to measure its effects on student's knowledge and behavioural intention to correctly manage waste. The study was carried out in elementary schools that had an average demographic and socio-economic level.

This study evaluated student's knowledge of environmental issues and problems to the level of their attitude and intention. The environment education was identified, and the effects of some factors such as family, school and communities on their environmental knowledge, attitude and behaviour intention were investigated.

The effectiveness of environmental education activities using a one-time environmental education and 6-month workshop approach, created by the author, on fourth grade student's environmental knowledge was examined. The study used a treatment – control design to measure the impact of environmental education. The sample set included students from two elementary schools. Evaluation questionnaires were administered to all students before and after environmental education activities, where the treatment group participated in a workshop created by the author and school. In contrast, the control group was only exposed to environmental education that was an existing part of the school curriculum.

The study was successful at increasing student's knowledge, attitude and intention on solid waste management through workshop activities.

Acknowledgements

Firstly, I would like to express my sincere gratitude to my advisor Prof. Kato Takaaki name order for the continuous support during my PhD studies and related research, and for his patience, motivation, and immense knowledge. His guidance helped me in all aspects of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my PhD studies.

Many thanks also to Dr. Hoang Hai who provided me with the opportunity to join the ESD program in Kobe College, Kobe, Japan, preparing me from the pursuit of my master and doctoral degrees. He made it possible for me to obtain a scholarship from the Japan Student Services Organization (JASSO) enabling me to come to Japan.

My sincere thanks also goes to 古澤律子 先生 from 北九州市教育委員会 and Principal 池町真一 先生, and 清田 渚 先生 from あやめが丘小学校 whom facilitated the opportunity to attend EE at Kitakyushu elementary, and provided support when I studied at あやめが丘小学校. Without their precious support it would not have been possible to conduct this research.

My sincere thanks also goes to Principal Phan Thị Thu Ba and all the teachers of Ong Ich Khiem elementary school, Principal Bùi Can and all the teachers of Dung Si Thanh Khe elementary school, and Principal Ha and all the teachers of Le Dinh Ly elementary school, Da Nang, Vietnam who provided me an opportunity to evaluate EE at elementary school. Without their precious support it would not have been possible to conduct this research.

I thank my fellow lab mates for the stimulating discussions, and for all the fun we had in the last four years. In particular, I am grateful to Mr. Phan Hoang Hai for collaborating with me in executing the EE activities in Da Nang, Vietnam.

Last but not the least; I would like to thank my family: my parents, my brothers and my husband for supporting me spiritually throughout the writing of this thesis and my life in general.

CONTENT

List of Figures	5
List of Table	7
List of Abbreviations	8
List of Appendix	9
Chapter 1 INTRODUCTION	10
1.1 Background	10
1.1.1 History of environmental education	10
1.1.2 Education in Vietnam	14
1.1.3 Waste management problems in Vietnam	18
1.2 Problem statement	21
1.3 Research site selection	22
1.4 Objective of Study	25
1.5 Chapter plan	26
Chapter 2 LITERATURE REVIEW OF ENVIRONMENTAL EDUCATION	28
2.1. Introduction	28
2.2 Characteristics of childhood development	29
2.3 The theories of reasoned action and planned behavior	32
2.4 Theory on environmental education	34
2.5 Expansion of education methods for elementary students	37
2.5.1 Workshop	37
2.5.2 Drawing activities	38
2.6 Environmental education practice	39
2.6.1 Environmental education in Japan	39
2.6.2 Environmental education in Southeast Asia	41
2.6.3 Environmental education for elementary students in Vietnam	45
2.7 Lessons learned	48
Chapter 3 ONE-TIME ENVIRONMENTAL EDUCATION	50
3.1 Introduction	50
3.2 Methodology	51
3.2.1 School selection	51
3.2.2 EE activities and questionnaire survey design	52
3.3 Result	58

3.3.1 Student's basic environmental knowledge and their environmental protection behaviour:	58
3.3.2 Effect of environmental lesson by school:	62
3.3.3 Effect of environmental activities by the author	66
3.3.4 Student's thinking about authors environmental activities.....	71
3.4 Limitation.....	74
3.5 Conclusion.....	74
Chapter 4 OBSERVED ENVIRONMENTAL EDUCATION IN JAPAN AND DEVELOP ENVIRONMENTAL EDUCATION IN VIETNAM	76
4.1 Introduction	76
4.2 Methodology	76
4.3 Background of environmental education in two countries.....	77
4.3.1 Characteristics of elementary education	77
4.3.2 National environmental education policy.....	78
4.3.3 Difference between school in Kitakyushu city and Da Nang city	80
4.3.4 Environmental policy in Kitakyushu and Da Nang	80
4.3.5 Source separation practice in Kitakyushu and Da Nang	82
Kitakyushu.....	82
Da Nang.....	84
4.4 Observed elementary environmental education example in Kitakyushu	85
4.4.1 Goals of this environmental education	85
4.4.2 Evaluation criteria.....	85
4.4.3 Course outline	86
4.4.4 Contents of each lesson	86
4.4.5 Observation survey of students	89
4.4.6 Questionnaire survey	89
4.5 Development of an environmental education program for Da Nang city	93
4.5.1 Goals of this environmental education	93
4.5.2 Course outline.....	93
Contents of each lesson	93
4.6 Discussion	98
4.7 Conclusion.....	99
Chapter 5 6-MONTH ENVIRONMENTAL EDUCATION	101
5.1 Introduction	101

5.2 Methodology	102
5.2.1 The study subject selection	102
5.2.2 Survey 1 (2016/10/11 – 2016/11/01).....	105
5.2.3 Environmental education activities during 6 months and survey 2.....	111
5.2.4 Survey 3 (2017/03/07 – 2017/04/01).....	116
5.2.5 Analysis of student newspaper	116
5.3 Results	117
5.3.1 The impact to the student knowledge	117
5.3.2 Student newspaper results.....	127
5.3.3 Factors of intentions to participate in solid waste management	131
5.3.3.1 Estimation of original model for survey 1 (Model 1)	131
5.3.3.2 Modification of model structure for survey 1 (Model 2).....	133
5.3.3.3 Model 2 applied to the treatment school of survey 3 (Model 3)	137
5.3.3.4 Model 3 modified for the treatment school of survey 3 (Model 4).....	138
5.3.3.5 Model 5: Model 2 applied to the control school of survey 3	142
5.3.3.6 Effects of EE on student intention to participate in waste management....	143
5.3.5 Comparison between one-time EE and 6-month EE.....	144
5.4. Limitation.....	144
5.5 Conclusions	145
Chapter 6 IMPACT OF ENVIRONMENTAL EDUCATION AFTER 14 MONTHS	147
6.1 Introduction	147
6.2 Methodology	147
6.2.1 Education procedure and survey	147
6.2.2 Follow-up survey at 14 months	150
6.2.3 Environmental education control school.....	152
6.3 Research hypothesis	152
6.4 Results	155
6.4.1 Hypothesis 1	155
6.4.2 Hypothesis 2.....	158
6.4.3 Hypothesis 3	158
6.4.4 Hypothesis 4 and 5.....	161
6.4.5 Measurements student performance through their answers selected at surveys 1, 3 and 4	167

6.4.6 Short discussion about student knowledge when they join one-time EE and 6-month EE.	182
6.5 Limitation.....	183
6.6 Conclusions	183
Chapter 7 CONCLUSION AND RECOMMENDATION	185
7.1 Contribution to knowledge.....	185
7.2 Recommendations	188
References	190

List of Figures

Figure 1-1 Education system in Vietnam (NUFFIC, 2015)	17
Figure 1-2 Outline of Dissertation	27
Figure 2-1 Theories of reasoned action and planned behaviour (Ajzen & Fishbein, The Influence of Behavior on Attitudes, 2005).....	33
Figure 2-2 Curriculum development and the instructional process (Hungerford, Peyton, Bluhm, & Volk, 1994)	36
Figure 3-1 Location of school surveyed.....	51
Figure 3-2 Research structure	53
Figure 3-3 Content of our environmental education	55
Figure 3-4 Environmental education schedule.....	56
Figure 3-5 Result from game activities	57
Figure 3-6 Result from non - game activities.....	58
Figure 3-7 Student basic knowledge about environment	61
Figure 3-8 Student thinking how they can protect environment.....	62
Figure 3-9 Study time of student.....	63
Figure 3-10 Environmental knowledge assessment questions for students	64
Figure 3-11 Student knowledge about the environment before and after environmental lesson in school	65
Figure 3-12 shows changes of student knowledge from environment lesson after 1 year.....	66
Figure 3-13 Changing of student knowledge during 1 year of our survey.....	67
Figure 3-14 Student knowledge about solid waste management after our environmental activities in school.....	68
Figure 3-15 Comparison in student knowledge	69
Figure 3-16 Students' answers from survey 2, 3 and 4 one-time EE	70
Figure 3-17 Student checklist.....	72
Figure 3-18 Result from student checklist	73
Figure 4-1 Municipal solid waste management systems in Kitakyushu City	82
Figure 4-2 Waste Separation Types in Kitakyushu City	83
Figure 4-3 Questionnaire survey	90
Figure 4-4 Student knowledge before the environmental education lesson from the teacher.....	91
Figure 4-5 Student knowledge after environmental education lessons from the teacher	92
Figure 5-1 Locations of the schools surveyed.....	103
Figure 5-2 Research structure	104
Figure 5-3 Modified model for Da Nang elementary.....	107
Figure 5-4 Examples of questions from the CHEAKS attitude scale	109
Figure 5-5 Questions about solid waste management.....	110
Figure 5-6 Questionnaire survey 2	114
Figure 5-7 Treatment and control student's knowledge about solid waste management at survey 1	118
Figure 5-8 Treatment school student knowledge about solid waste management	119
Figure 5-9 Control school student knowledge about solid waste management	121
Figure 5-10 Control and treatment schools student knowledge about solid waste management	123
Figure 5-11 Showed difference of "Reason for recycling" question.....	125

Figure 5-12 Changing of student answers between survey 1-survey 2 and survey 2-survey 3.	126
Figure 5-13 Student newspaper contents summary.....	128
Figure 5-14 Frequency of keywords appearing in student's newspapers.....	129
Figure 5-15 standardised results of structural equation model 1.....	132
Figure 5-16 standardised results of structural equation model 2.....	135
Figure 5-17 Standardised results of structural equation model 3	137
Figure 5-18 standardised results of structural equation model 4.....	140
Figure 5-19 Standardised results of structural equation model 5	142
Figure 6-1 Structure follow up questionnaire survey	148
Figure 6-2 Shows question 16 to question 21	151
Figure 6-3 Comparison between treatment and control schools	155
Figure 6-4 Difference of student answer in survey 3 and 4	158
Figure 6-5 Difference between students who had good scores between survey 3 and 4 - treatment school	159
Figure 6-6 Change in students who had a good score between surveys 3 and 4 - treatment school	160
Figure 6-7 Student's daily life behaviour - treatment school	161
Figure 6-8 Student's daily life behaviour - control school.....	162
Figure 6-9 Student's memory about EE.....	164
Figure 6-10 Environmental activities that students from 2017 to 2018	165
Figure 6-11 Treatment student answers in recycle for profit question.....	171
Figure 6-12 Treatment student answers for 3Rs question.....	172
Figure 6-13 Treatment student answers in waste treatment method question.....	173
Figure 6-14 Control students' answers to waste treatment method question.....	175
Figure 6-15 Treatment student answers in Eco-bag question	176
Figure 6-16 Control student answers in Eco-bag question.....	177
Figure 6-17 Treatment school student's answers for the 3Rs question.....	178
Figure 6-18 Control student answers in 3Rs question.....	179
Figure 6-19 Treatment student answers for reason for recycling question	180
Figure 6-20 Control student's answers for reason for recycling question.....	181
Figure 6-21 Nearest meaning question in 6-month and one-time EE questionnaire survey.	182
Figure 6-22 Changing of student knowledge	182

List of Table

Table 1-1 Competence of each ministry in waste management	20
Table 2-1 Stages of teaching method according to Piaget	31
Table 2-2 Summary of EE pilot project in Southeast Asia	42
Table 2-3 Primary education: weekly lesson timetable (national guide lines).....	46
Table 2-4 Vietnamese elementary guide book curriculum	47
Table 3-1 Information about Hai Chau and Thanh Khe district in Da Nang city, Vietnam.....	52
Table 3-2 Number of student engaged in one-time EE	53
Table 3-3 Number of student attend our survey from 2014 to 2015	59
Table 3-4 Behaviour of student when they throw away garbage	60
<i>Table 3-5 Comparison of results between with/out game</i>	<i>69</i>
Table 4-1 Characteristics of elementary education in Japan and Vietnam	78
Table 4-2 Environmental education objectives in Japan and Vietnam	79
Table 4-3 Difference in characteristics of elementary school in Kitakyushu and Da Nang city	80
Table 4-4 city policy from Kitakyushu and Da Nang	81
Table 4-5 Evaluation criteria of students	86
Table 4-6 Course outline of Da Nang application.....	93
Table 4-7 Questions to go over material learned in the last lesson.....	95
Table 4-8 Difference between this study and Kitakyushu model.....	98
Table 5-1 Treatment and control school.....	103
Table 5-2 Summary of survey questions.....	106
Table 5-3 Adoption questions from CHEAKS scale.....	108
Table 5-4 Environmental activities guideline	112
Table 5-5 Number of students involved in the study	117
Table 5-6 Chi-square test for Figure 5-7 (before environmental workshop)	118
Table 5-7 T-test results for Figure 5-8	119
Table 5-9 T-test results for the control school in Figure 5-9.....	122
Table 5-10 Chi-square test for after environmental workshop of Figure 5-10.....	123
Table 5-11 T-test results between survey 1 and survey 2 from treatment school	124
Table 5-12 T-test results between survey 2 and survey 3 from treatment school	124
Table 5-13 Elements included in their drawings by students participating in the study	130
Table 5-14 Model fit of alternative models tested.	132
Table 5-15 Factor Loading from Maximum Likelihood with Varimax Rotation for a Four- Factors Solution for environmental education attitude questions	134
Table 5-16 Standardised model 2 regression weights for VC, ATB, SN and PBC.....	136
Table 5-17 Related model litems.....	137
Table 5-18 Factor loading in the treatment school at survey 3	139
Table 5-19 Standardised regression weights for the VC, ATB, SN and PBC model 4.....	141
Table 5-20 Standardised regression weights for the VC, ATB, SN and PBC for Model 5.....	143
Table 6-1 Shows question 9 to 14	149
Table 6-2 Number of schools and students that joined surveys 3 and 4	150
Table 6-3 Comparison of students' knowledge after one year.....	156
Table 6-4 Comparison of student knowledge in the treatment school	158
Table 6-5 Student right answers at surveys 1, 3 and 4	169

List of Abbreviations

EE	Environmental education
ESD	Education for sustainable development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UIS	UNESCO Institute for Statistics
SDGs	Sustainable Development Goals
MSW	Municipal solid waste
PE	Pollution education
PIS	The period for integrated study
ECCE	Early childhood care and education
MOET	the Ministry of Education and Training
MONRE	the Ministry of Environment and Natural Resources
MOC	the Ministry of Construction
MARD	the Ministry of Agriculture and Rural Development
MOH	the Ministry of Health
MPI	the Ministry of Planning and Investment
MF	the Ministry of Finance
VC	Verbal commitment
SN	Subjective norm
PBC	Perceived behavioral control
ATB	Attitude toward behavior
GAP-ESD	Global Action Programme on Education for Sustainable Development
URENCO	Urban Environment Company
JICA	Japan International Cooperation Agency
SWM	Solid waste management

List of Appendix

Appendix A: Questionnaire survey 1 for one-time EE	198
Appendix B: Questionnaire survey 3 for one-time EE.....	205
Appendix C: Questionnaire survey for 6-month workshop EE	210
Appendix D: Questionnaire survey for 14 months after 6-month EE.....	213
Appendix E: Pictures of one-time EE from 2014-2015	216
Appendix F: Newspaper from treatment school.....	218

Chapter 1 INTRODUCTION

1.1 Background

1.1.1 History of environmental education

The world is facing serious global environmental problems every day, such as: climate change, air pollution, water pollution, solid waste issues. Countermeasures against the environmental issues have been examined in the natural sciences, social sciences and humanities, as well as through interdisciplinary approaches. Naturally, education has been one of these countermeasures. Environmental education (EE) has been expected to play a vital role in seeking solutions to environmental problems (Imamura, 2017).

The field of EE has a history of over forty years and much longer if fore runners such as nature studies, outdoor and conservation educations are included. It has received considerably more attention in recent years as contested notions of environment and sustainability have become common topics of conversation among the public, the subject of media interest, and the focus of much political debate and legislation (Stevenson, Brody, Dillon, & Wals, 2013). Perhaps EE has its roots in the nature studies movement of the early 1900s or the public awakening to pollution and general environmental problems in the first Earth Day in 1970 (McCrea, 2006).

However, as more people began to fear the fallout from radiation, the chemical pesticides mentioned in Rachel Carson's *Silent Spring*, and the significant amounts of air pollution, water pollution and waste, the public's concern more about their health and the environment (Eneji & Akpo, 2017). EE has been defined and redefined over the last twenty-five years. Definitional issues are inherent in a field this broad and encompassing. It is generally agreed that EE is a process that creates awareness and understanding of the relationship between humans and their many environments – natural, man-made, cultural, and technological. EE is concerned with knowledge, values, and attitudes, and has as its aim responsible environmental behaviour (Binstock, 2006).

Since the 1970s there is a consensus that EE is crucial for achieving the goals of sustainable development, by creating an environmentally literate citizenry capable and motivated towards environmentally responsible lifestyles (UNESCO, 1997; UNESCO-UNEP, 1978; UNESCO-UNEP, 1992) (Goldman, Yavetz, & Pe'er, 2014). The magnitude of this challenge is such that in 2005, UNESCO launched the Decade of Education for Sustainable Development. Underlying this endeavour is the understanding that education is the driving force for the change needed (UNESCO, The 2005 convention on the Protection and Promotion of the Diversity of Cultural Expressions, 2005). EE and education for sustainable development (ESD) have become a growing priority at the local, national and international levels in recent years (Binstock, 2006). While there is often overlap between concepts of EE and ESD, however the importance of EE and ESD is achieving sustainable development goals for the environment.

The public became concerned over our effects on the environment around the world. Events that both celebrated the environment as well as attention to the issues affecting it became increasingly popular. Earth Day was born. Those that taught about the environment called for a new type of curriculum that included an examination of the values and attitudes people used to make decisions regarding the environment (Einstein, 1995). Environmental educators began work towards a common definition for EE. Much of the work on EE within the last quarter century has been guided by the Belgrade Charter (UNESCO, Activities of the UNESCO-UNEP International Environmental Education Programme: 1975-1983, 1984) and the Tbilisi Declaration (UNESCO & UNEP, The Tbilisi Declaration, 1977). These two documents furnish an internationally accepted foundation for EE.

Belgrade Charter, 1975 - The Belgrade Charter was developed in 1975 at the United Nations Educational, Scientific, and Cultural Organization Conference in Measuring the Success of EE Programs. Yugoslavia, and provides a widely accepted goal statement for EE: The goal of EE is to develop a world

population that is aware of, and concerned about, the environment and its associated problems, including the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO, Intergovernmental Conference on Environmental Education: Final Report, 1975).

Tbilisi Declaration, 1977 - Following Belgrade, the world's first Intergovernmental Conference on EE was held in Tbilisi, Georgia. Building on the Belgrade Charter, representatives at the Tbilisi Conference adopted the Tbilisi Declaration, which challenged EE to create awareness and values amongst humankind in order to improve the qualities of life and the environment. A major outcome of Tbilisi was detailed descriptions of the objectives of EE. Most EE has since universally adopted these objectives. Awareness – to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems (UNESCO, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, 1978).

Knowledge – to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

Attitudes – to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills – to help social groups and individuals acquire the skills for identifying and solving environmental problems.

Participation – to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems (UNESCO, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, 1978).

Measuring the Success of EE Programs and Characteristics of EE. The outcomes of Tbilisi and Belgrade have, in many ways, provided the basis for

many EE programs. Certainly, having both a commonly accepted goal statement and associated set of objectives has allowed many educators to better address the desired outcomes of their programs (UNESCO & UNEP, The Tbilisi Declaration, 1977). Equal to the need to identify both a common goal and set of objectives, is the need to consider the characteristics of EE. EE is a process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness of man, his culture and his biophysical surroundings. EE also entails practice in decision – making and self – formulating of a code of behaviour about issues concerning environmental quality (Martin, 1975). To develop a world population that is aware of, and concerned about, the environment and it's associated problems, and commitment to work individually and collectively toward solutions of current problems and prevention of new ones (UNESCO & UNEP, The Belgrade chapter: A Framework for Environmental Education, 1975).

EE is increasingly a prominent part of primary, secondary and tertiary education in many developing countries. The formal education sector plays a vital role in EE and awareness by exposing the younger generation to the information, issues, analyses and interpretations on environment and development. A number of factors have influenced the development of EE in the region. EE should be a part of the school curriculum because student knowledge of environmental concepts establishes a foundation for their future understandings and actions as citizens (UNESCO. Director-General, 2014).

The UN Decade on Education for Sustainable Development 2005-2014 envisioned a world “where everybody has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation” (UNESCO, UN Decade of Education for Sustainable Development 2005 - 2014 The DESD at a glance, 2005). ESD is recognized as a key element EE and a crucial enabler for sustainable development which is at the heart of the 2030 Agenda for Sustainable

Development. Target 4.7 of Sustainable Development Goal 4 (SDG 4): “By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development” (UNESCO & UIS, Quick Guide to Education Indicators for SDG 4, 2018).

The UNECE (United Nations Economic Commission for Europe) affirms that “education must play a role in enabling people to live together sustainably” and that this will require working with learners across all levels and types of education, formal, non-formal and informal (Chandran & Gunawardena, 2017). The three modes of education are defined as below:

- Formal education is carried out in school systems and is based on established curriculum methods.
- Non-formal education occurs outside the formal system, in other organized learning settings.
- Informal education results from daily life activities related to work, family or leisure, and is provided within families, religious organizations, and community groups, as well as by news organizations, social media and various forms of entertainment (UNFPA, 2017).

1.1.2 Education in Vietnam

Vietnam is a country in Southeast Asia of 331,211.6 square kilometers in area. In 2018, Vietnam’s GDP growth rate hit a 10-year record high of 7.08%, making it one of the top growth performers in the region and the world (Pwc Vietnam & Vietnam Chamber of Commerce and Industry, 2019). Vietnam’s population reached 97 million in 2018 (up from about 60 million in 1986), 70% of the population is under 35 years of age, with a life expectancy of 76 years, the highest among countries in the region at similar income levels (The World Bank

in Vietnam, 2019). Urbanization and strong economic and population growth are causing rapidly increasing waste management and pollution challenges. Waste generation in Vietnam is expected to double in less than 15 years (The World Bank in Vietnam, 2019).

Vietnam has seen many changes in the long history of its educational development. During the feudal period (from the tenth century to the nineteenth century), the education system was mainly accessible to selected classes and intellectual elites, to maintain and develop contemporary feudalism (Ministry of Education and Training, 2014).

For one thousand years, Vietnamese people used Chinese characters in their language system, but pronounced it in a Vietnamese way (Nguyen & Nguyen, 2008). At the end of 19th and first half of 20th centuries, the French forcibly colonized Vietnam and the entire Indochina. The traditional education was replaced by French-Vietnamese education aimed mainly at training people to serve the colonial apparatus. Under the French-Vietnamese education system, French was the dominant language (Nguyen & Nguyen, 2008).

In 1975, the communist north and the country's south that was supported by the US were reunited, and the Socialist Republic of Vietnam was declared. The Government focused on two tasks: (1) removal of leftover influences from the old education system; (2) implementation of anti-illiteracy activities for people 12-50 years old. The Ministry of Education quickly developed and issued a new 12-year curriculum, and developed and printed 20 million copies of new textbooks to replace the old ones used in the South (Nguyen & Nguyen, 2008).

The biggest challenge faced by Vietnamese education in the early 1980s was that the State was not able to provide financial resources that made education to face a serious shortage of resources. To solve the financial problem, in 1986, the Vietnamese Government made major national reforms throughout the whole country. Some solutions used in the reform of general education were as follows.

The Government allowed the collection of tuition fees at all levels; permission was given to open private kindergartens and semi-public and people-founded classes/schools at all levels.

Since 1990, the Ministry of Education and Training (MOET; Bo Giao Duc va Dao Tao) has been responsible for all forms of education in Vietnam. The duties of the MOET include submitting proposals to the National Assembly (the government) for the founding of new schools or merging of existing education institutions, creating and publishing new textbooks and curricula, drawing up guidelines for the admission of students, and issuing certificates and diplomas (NUFFIC, 2015). To establish more educational institutions, MOET permitted the creation of private institutions for higher education. In 2006, the Hoa Sen University, a private university was founded, and in 2008 the Van Xuan University of Technology. Higher education will also become more international, and Vietnamese higher education institutions entered into partnerships with foreign partners (e.g. joint ventures, sandwich programmers) (NUFFIC, 2015).

After 10 years of this reform in the education sector, in the 1993-1994 school-year the dropout rate decreased from 12.7% in 1989-1990 to 6.58% and repetition rate fell from 10.6% in 1989-1990 to 6.18% (Nguyen & Nguyen, 2008).

A new school curriculum and textbooks were introduced in the 2002-2003 school-year and should become universal by the 2008-2009 school year, thus laying the preconditions for improved educational quality (Nguyen & Nguyen, 2008). Figure 1-1 shows the education system in Vietnam.

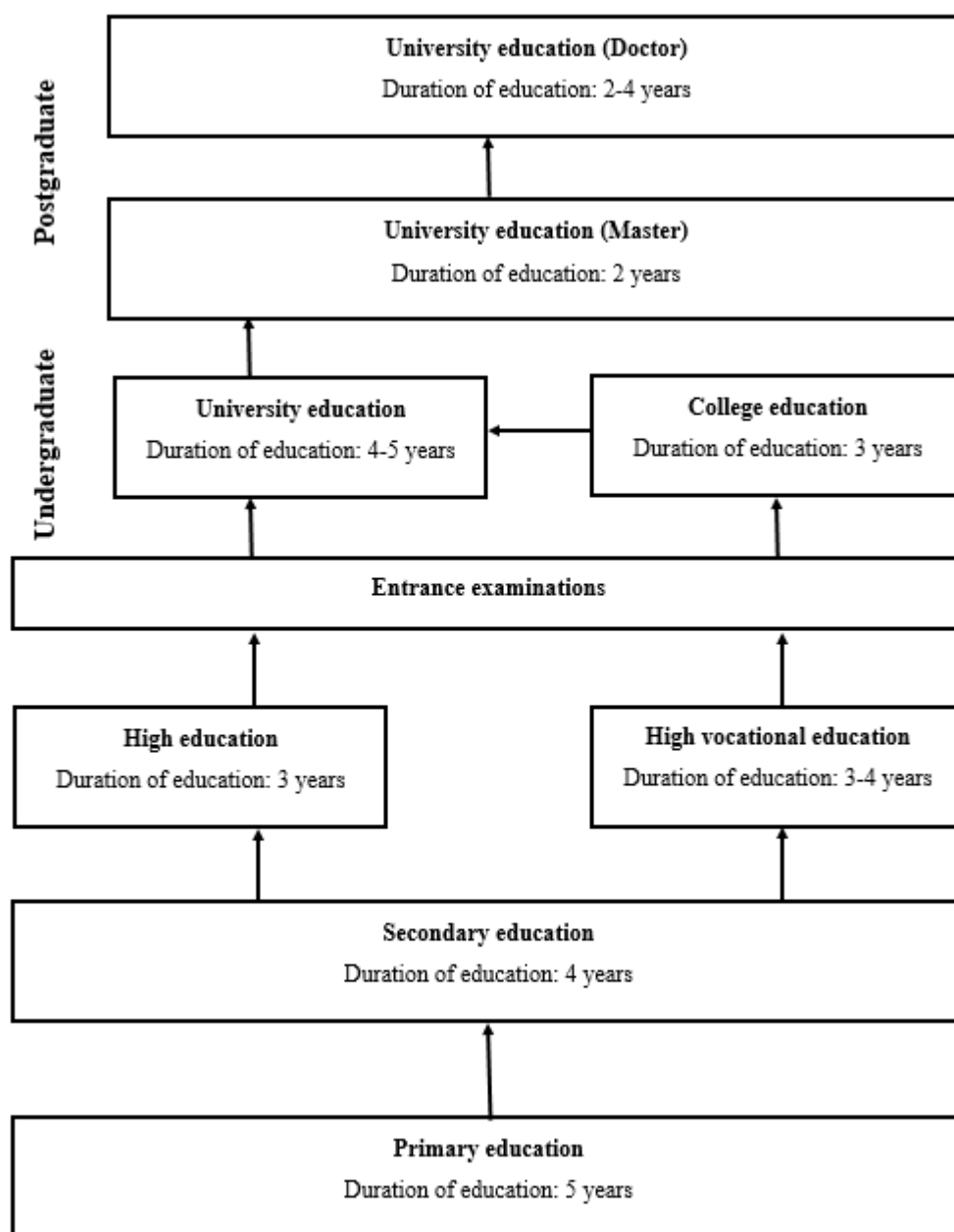


Figure 1-1 Education system in Vietnam (NUFFIC, 2015)

1.1.3 Waste management problems in Vietnam

In developing countries, it is common that 30-60 % of urban solid waste is uncollected and that open dumping in addition to open burning is the norm (Garg, 2013). Increasing waste generation due to rising population and waste generation rate has become a challenge for many developing countries including Vietnam, as government fights to establish proper municipal solid waste (MSW) management protocols. Poor waste management is a common growing problem facing developing countries. Recently, Vietnam has faced great challenges in solid waste management including not only the collection, transfer, and final disposal of waste, but also a lack of public awareness of the solid waste system, haphazard urbanization, introduction of environmentally unfriendly materials, and changing consumption patterns. Therefore solid waste is a growing problem for Vietnam, especial in big cities with rapidly increasing populations. The country is producing more than 15 million tons of waste each year, and this volume is expected to grow rapidly over the next decade. Urban areas produce more than 80% or 12.8 million ton/year of the country's MSW. Solid waste in Vietnam's urban areas is mainly composed of food waste, paper, plastic, wood, metal, and glass, with some hazardous household waste such as fluorescent lights, and batteries (Leroy & Vuong, 2015). Currently there is not an effective mechanism of publicly organized recycling in Vietnam. The government has been trying to implement a waste separation and recycling policy throughout the country, but Vietnamese Government has not yet succeeded mainly due to a lack of funding and human resources in the public sector (Nguyen & Matsui, 2011).

Seventy-five percent of globally exported waste ends up in Asia. Since July 2017, when China began to ban imports of plastic waste, Southeast Asia in particular has become a dumping ground for wealthier countries' waste (Marks, 2019). Waste generation in Asian urban areas is around 450,000–760,000 tonnes/day and this is expected to reach about 1.8 million tonnes/day by 2025 (Curea, 2017). With rapid industrialization, urbanization, economic growth, and

special export waste from developed countries, the quantity of municipal solid waste and the associated problems are becoming a serious issue in Southeast Asia. Many Southeast Asian countries have policies in place to solve the aforementioned problems. Nevertheless, the primary focus is on the downstream solutions for which local governments allocate significant funds for waste collection and recycling/disposal, but without adequate consideration for EE of the young generation.

Urbanization has now become one of the most important issues and challenges for Vietnam in efforts to pursue sustainable development. Hence, Vietnam is faced with a solid waste management problem too. Urbanization has led to the migration of people from villages to big cities with a dream of making a lot of money to improve their living standards. In Vietnam, municipal solid waste has become an increasingly complex issue attributed to reasons such as increasing quantity, changing composition, and a lack of rising public awareness and municipal administration policies among different cities and surrounding communities (Nguyen & Matsui, 2011).

Waste institutional governance in Vietnam is plural: each department handles waste issued from their activity field. At both national and local levels, there is no entity in charge of coordinating the waste management system. The Ministry of Environment and Natural Resources (MONRE) is responsible for the management of hazardous waste, the Ministry of Agriculture and Rural Development (MARD) takes care of waste from agriculture, the Ministry of Planning and Investment (MPI) and the Ministry of Finance (MF) are not directly involved in the waste management system, but they plan and elaborate strategies relating to waste treatment projects and control the public finances of the sector. (Leroy & Vuong, 2015). In fact, the organizational structure is likely to cause overlapping of responsibilities between many ministries (MONRE 2011). For the same type of waste, such as healthcare waste, three ministries are competent: the Ministry of Health (MOH), which implements regulations on waste management

in health facilities, the Ministry of Construction (MOC), which controls waste treatment facilities and MONRE, which regulates and controls the management of hazardous hospital waste (Leroy & Vuong, 2015).

Table 1-1 Competence of each ministry in waste management

MONRE	<ul style="list-style-type: none"> - Gives guidelines, plans, controls the waste management in the context of environmental policy. - Provides reference standards - Handles domestic waste with MOC - Responsible for hazardous waste - Responsible for health and industrial waste
MOC	<ul style="list-style-type: none"> - Gives directives in management, investment and construction of waste treatment sites. - Manages the construction waste with MONRE - Handles domestic waste with MONRE - Handles waste from the Craft villages
MARD	<ul style="list-style-type: none"> - Plans and manages waste from agriculture with MONRE
MOH	<ul style="list-style-type: none"> - Manages waste from health facilities with MONRE - Gives guidelines for healthy waste management, supervises their implementation.
MPI	<ul style="list-style-type: none"> - Plans investment projects - Develops investment strategies - Attracts domestic and foreign funding
MF	<ul style="list-style-type: none"> - Implements and controls the budget for waste management projects

* (Leroy & Vuong, 2015)

Vietnam produces more than 27.8 mil tons/year waste from various sources where municipal, agricultural and industrial wastes are main sources. More than 46% (12.8 mil tons/year) are from municipal sources including

households, restaurants, markets, and businesses (Schneider, Le, Wagner, Reichenbach, & Hebner, 2017).

Hanoi, Ho Chi Minh City (HCMC), Haiphong, Da Nang and Can Tho are the five biggest cities in Vietnam, and are hotspots contribution 70% to the total waste generation. In 2018, the average MSW of big urban areas increased to 0.9–1.10 kg/person/day which general is 1.31 kg/cap/day in urban areas and 0.86 kg/cap/day in rural areas (Berg, et al., 2018).

Numbers from Vietnam's Association of Plastic illustrate the scale of the problem. In 1990, each Vietnamese consumed 3.8kg of plastic per year, but 25 years later, the figure hit 41kg (Vietnam News, 2019). SWM (solid waste management) is one of the most important environmental problems of Vietnam.

1.2 Problem statement

There are a limited number of researches in Vietnam about EE activities for students from different grades. Most of the studies have been carried out at the university level. It should be taken into account that the every student is not able to complete university education. Having said that, elementary level education appears to be essential in raising environmental awareness of students as Vietnam achieved universal primary education in 2000 throughout the entire country. During the period between 2001 and 2010, net enrolment rates in Vietnam increased from 94 per cent to 97 percent in primary education, which was 12 % higher than the secondary level (Ministry of Education and Training, 2014).

Up-to-date EE may be the key to tackling environmental issues. In Vietnam, EE became one of the significant policies in addressing serious environmental problems caused by its tremendous economic growth. Vietnam has been trying to implement a garbage separation and recycling policy throughout the country, but had not yet succeeded mainly due to lack of funding and human resources in the public sector. Though various activities have been conducted, most approaches are still limited in providing children with sufficient

knowledge about environmental issues at their schools. In addition, education for solid waste treatment is not systematically done in Vietnam.

The quantities of MSW in Vietnam have been increasing significantly making the expenses used for collection, transportation, treatment and disposal increase (Nguyen, Hoang, Bui, & Nguyen, 2013). With current MSW management practices and challenges, the different methods for the disposal and treatment of MSW being applied in Vietnam are as follows: Open dumping and landfill, composting, incineration and recycling. For these solutions to be successful, solid waste education is an important component educating on the practice of wastes separation at the sources. Recently, solid waste education is not spoken about in Vietnam, special in elementary school.

From the problem statement, these research questions are considered in the thesis:

1. What are the characteristics of EE in Vietnam?
2. How to create and develop EE in Vietnam?
3. How to evaluate the impact of environmental activities for elementary student in Vietnam?

To answers these questions, the study chose Da Nang city – one of the 4 biggest cities in Vietnam, to start the research.

1.3 Research site selection

Vietnam has set national targets on emissions reduction, and Da Nang is in the process of developing targets locally (APEC, 2014). The Da Nang People's Committee committed to and promulgated a comprehensive environmental plan for Da Nang City in August 2008 called 'Building Da Nang City as An Environmental City (No.41 / 2008 / QD-UBND). It set a 2020 vision for many different environmental issues such as: air pollution reduction, waste treatment and recycling, energy conservation, and renewable energy. The plan is based on Agenda 21 of the Vietnamese government (Prime Ministerial Decision, No.

153/2004) and Vietnamese environmental standards 2, where 2020 was set as the target year. The general goals for the Environmental City Plan are to:

- Provide a safe and healthy environment for people, assuring land, and water - air quality.
- Prevent environmental pollution and degradation (APEC, 2014).

Da Nang is one of the four biggest cities in Vietnam where the gross domestic product (GDP) growth rate has been higher than the country's national average. Between 2017 and 2018, Da Nang's regional GDP grew 7.9 percent annually whereas the national GDP was 7.1%, totalling US\$1.655 billion in 2018. Da Nang is located in the middle of Vietnam, having a population of 1,064 million in 2018 according to the statistical yearbook of the city. The economy has historically been dominated by the industrial and construction sectors but is slowly changing. In 2006, the services sector became the largest economic sector in the city as measured by gross output. This shift is in keeping with local policy targets, which seek to develop the city as a rail, road, and seaport hub, in addition to other services-oriented industries like financing, banking, insurance, telecommunications, and consulting to name a few. The tourism sector is also expected to grow, as the city strives to become a major national tourist sector that capitalizes on the city's beaches and proximity to the old capital, Hue; Hoi An Ancient Town; and the ruins at My Son (Ostojic, Bose and Krambeck 2013). After more than 20 years of development, Da Nang has gained much prosperity: tourism products are more diversified and enriched, with a high tourist growth rate of 21.93% between 2007-2016. The average revenue from tourism reached 29.6% of Da Nang GDP. However, the process of exploiting and developing tourism has led to environmental pollution, the loss of biodiversity, and destruction of the ecological environment of the city. In 2017, Da Nang was chosen as the venue for the APEC 2017 Economic Leaders Week 05-11 November. This coastal city and major economic centre of Vietnam, is distinct for its vibrant development in line with being environmentally sustainable. It is

noteworthy to have a look at Da Nang's efforts and future plan in accomplishing environmental sustainability which is part of the reason why it is considered as Vietnam's "worth-living" and smart city. The EE materials used in Da Nang are merely translations and improvements of Japan's version of sustainability, applied in Vietnam.

The city of Da Nang is one of the major port cities in Vietnam (in addition to Ho Chi Minh City and Haiphong) and the biggest city on the South Central Coast of Vietnam. Da Nang is listed as a first class city, and has a higher urbanization ratio than any centrally governed city. The administrative area of the city is composed of 6 districts and 2 suburb districts; one of these is an island suburb with an area of 305 km². The total area of Da Nang is 1285.43 km². Da Nang is located in the middle of Vietnam, having a population of 1.064 million in 2018 with a large number of people traveling in from other municipalities to work according to the statistical yearbook of the city. The economy has historically been dominated by the industrial and construction sectors but is slowly changing. In 2006, the services sector became the largest economic sector in the city as measured by gross output.

According to the survey data of URENCO (Urban Environment Company), Da Nang City collected about 268 thousand tons of municipal solid waste in 2013, and the collection rate for 2012 was 92%. Per capita waste generation in Da Nang City is 0.675 kg per day in 2010 (Japan International Cooperation Agency (JICA) data) (JICA, The Preparatory Survey on Wastewater Management and Solid Waste Management for Da Nang City The Socialist Republic of Viet Nam, 2014). MSW in Da Nang composed of 68.47% food waste, 5.07% paper, 2.89% cloth, 2.79% wood, 11.36% plastic, 0.14% glass, 1.45% metal, 0.02% hazardous waste and 3.15% other waste (Nguyen D. H., 2018). With its designed capacity, the Khanh Son Landfill will be closed by 2020. Operating since 2007, the Khanh Son landfill site has been an urban solid waste treatment facility with sanitary landfill technology in Hoa Khanh Nam Ward,

Lien Chieu District, Da Nang. There is an urgent need for reduction, reuse and recycling measures for MSW. Recently, there are some projects in Da Nang for sustainable solid waste management, such as: eco-city project at Cam Le district, and composting of agricultural waste at Hoa Vang suburban district (Nguyen D. H., 2018). However, EE is not formal education at elementary school in Da Nang, Vietnam, and students do not have basic knowledge about solid waste management.

1.4 Objective of Study

- A. The aims of this study to solve problem statement: What are characteristics of EE in Vietnam?
 - A.1 Review literature
 - A.2 Summarize Vietnamese textbook and EE contents from elementary textbook
- B. How to create and develop EE in Vietnam?
 - B.1 Develop one-time education course
 - B.2 Develop 6-month workshop course
- C. How to evaluate the impact of environmental activities for elementary student in Vietnam?
 - C.1 Develop evaluation method
 - C.2 Measurement of the impacts of EE from textbook.
 - C.3 Evaluation of one-time education
 - C.4 Evaluation of 6-month education
 - C.5 Evaluation of the effect of EE after 14 months

1.5 Chapter plan

This dissertation is divided into 7 chapters:

Chapter 1 contains a description of the background research topic and issues. The main content of this chapter: the research problem and research objectives.

Chapter 2 describes the literature review of EE for elementary students with theoretical descriptions of relevant theories that can be used to explain the methodology that was used in the study. Also contains state of the similar research that had been done.

Chapter 3 is one-time EE that was done for the study in elementary schools of Da Nang, Vietnam.

Chapter 4 is observation activities at Japanese elementary school (Kitakyushu, Japan)

Chapter 5 create workshop activities for student in Vietnam base on education in Japan.

Chapter 6 evaluation the impacts of workshop activities after 14 months and

Chapter 7 contains details of the discussion, conclusion and future plan.

The outline diagram of the dissertation is shown in Figure 1-2. In the outline diagram, you can find a short summary of chapters 3, 4, 5 and 6.

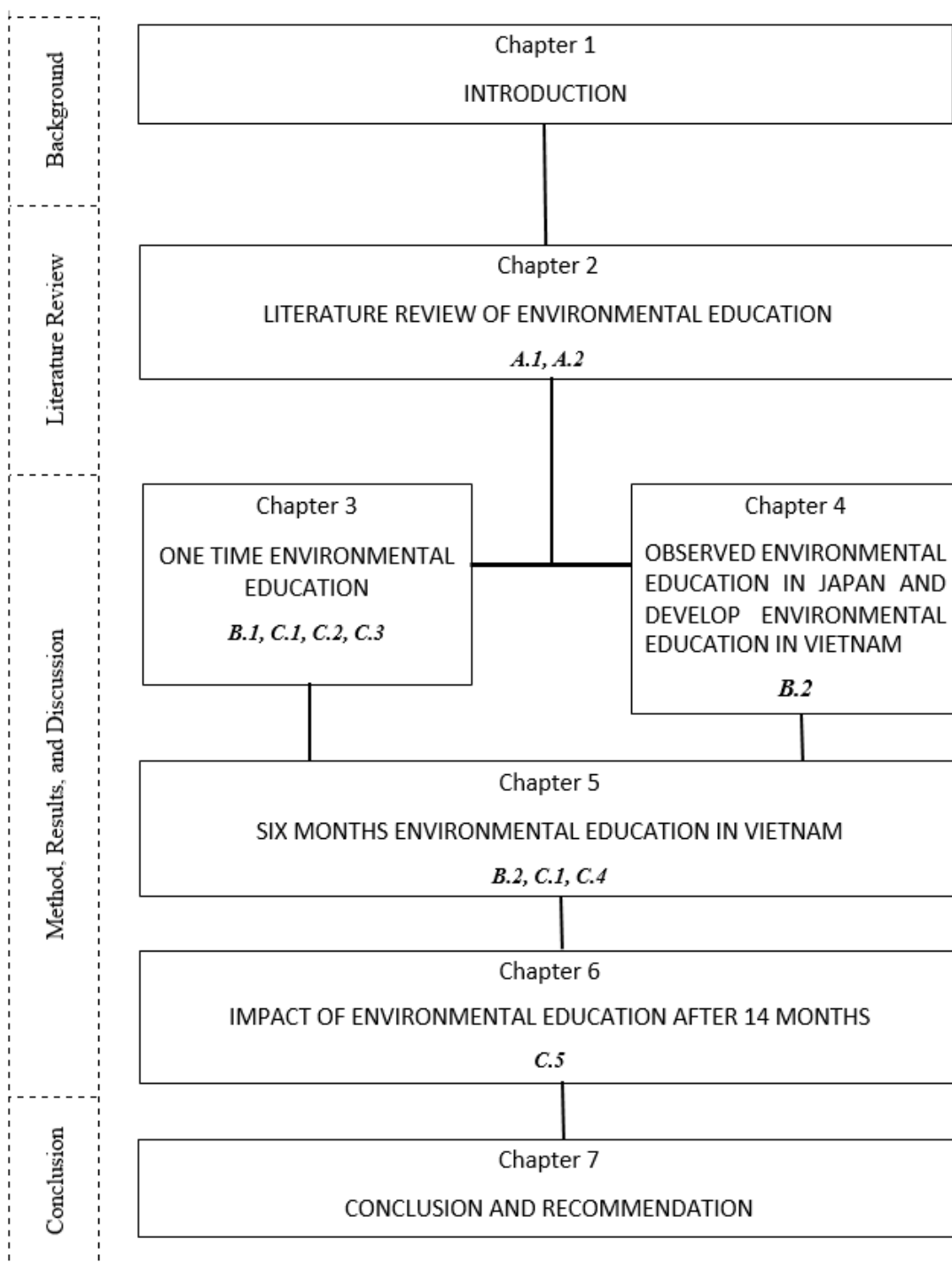


Figure 1-2 Outline of Dissertation

Chapter 2 LITERATURE REVIEW OF ENVIRONMENTAL EDUCATION

2.1. Introduction

It is necessary to understand the characteristics of environmental education and the situation in Vietnam before creating EE programs. The grade-level differences in the relationships of students' perceived academic support (from parents, teachers and peers) to academic achievement directly and indirectly, through their perceived academic engagement (Chen, 2008). The lack of research in EE, especially with regards to children in elementary schools, is not only a Vietnam specific phenomenon. Most international studies have focused on environmental knowledge and education of high school students, leaving the elementary level untouched (Harold, 1982). However, the significance of EE is highlighted by research findings suggesting that students at the elementary and secondary levels acquire most of their knowledge about the environment from classes in school (Fatma & Semra, 2013). There are several reasons to carry out EE activities geared towards elementary students. A major benefit is the impact it can have on their knowledge and behaviour. The definitive aim of environmental educators is to change individual behaviour toward the environment by producing environmentally literate and responsible citizens (Knapp, 2000). Varela-Losada, Vega-Marcote, Perez-Rodríguez, and Alvarez-Lires pointed out the compulsory character of EE, whose contents showed human communality and was different from general scientific education, skill education, or general knowledge education (Varela-Losada, Vega-Marcote, Pérez-Rodríguez, & Álvarez-Lires, 2016).

The main aims of this chapter are to find research subjects and understand the characteristics of the chosen subject. In addition, this chapter may be summarized as:

- Characteristics of childhood development

- The theories of reasoned action and planned behavior
- Theory on environmental education
- Expansion of education methods for elementary students including workshop method and drawing analysis method
- Environmental education in Japan

2.2 Characteristics of childhood development

Jean Piaget's work on children's cognitive development, specifically with quantitative concepts, has garnered much attention within the field of education. Piaget explored children's cognitive development to study his primary interest in genetic epistemology. Upon completion of his doctorate, he became intrigued with the processes by which children achieved their answers; he used conversation as a means to probe children's thinking based on experimental procedures used in psychiatric questioning (Ojose, 2008).

Piaget believed that the development of a child occurs through a continuous transformation of thought processes. The developmental stage consists of a period of months or years when certain development takes place. Although students are usually grouped by chronological age, their development levels may differ significantly (Weinerta & Helmke, 1998), as well as the rate at which individual children pass through each stage. This difference may depend on maturity, experience, culture, and the ability of the child (Papalia & Olds, 1996). According to Berk (1997), Piaget believed that children develop steadily and gradually throughout the varying stages and that the experiences in one stage form the foundations for movement to the next (Berk, 1997). All people pass through each stage before starting the next one; no one skips any stage. This implies that older children, and even adults, who have not passed through the later stages process information in ways that are characteristic of young children at the same developmental stage (Eggen & Kauchak, 2013).

From his observation of children, Piaget understood that children were creating ideas. They were not limited to receiving knowledge from parents or teachers; they actively constructed their own knowledge. Piaget's work provides the foundation on which constructionist theories are based (Wood, Smith, & Grossnoklaus, 2011).

Constructionists believe that knowledge is constructed and learning occurs when children create products or artifacts. They assert that learners are more likely to be engaged in learning when these artifacts are personally relevant and meaningful. In studying the cognitive development of children and adolescents, Piaget identified four major stages: sensorimotor, preoperational, concrete operational and formal operational. Piaget believed all children pass through these phases to advance to the next level of cognitive development. In each stage, children demonstrate new intellectual abilities and an increasingly complex understanding of the world. Stages cannot be "skipped"; intellectual development always follows this sequence. The ages at which children progress through the stages are averages -- they vary with the environment and background of individual children. At any given time a child may exhibit behaviors characteristic of more than one stage.

The years between 6 and 14 — middle childhood and early adolescence — are a time of important developmental advances that establish children's sense of identity. Children make strides toward adulthood by becoming competent, independent, self-aware, and involved in the world beyond their families (Eccles, 1999).

Environmental education programs aiming to enhance children's environmental attitudes in a pro-environmental direction require background information, such as age and sex differences, to ensure appropriate design. Liefländer (2014) showed in a test design that students 9-10 years of age revealed to be more responsive concerning positive attitude shifts than older students 11-

13 years of age, where the genders were equally influenced (Liefländer & Bogner, 2014).

Table 2-1 Stages of teaching method according to Piaget

Ages	Method
Early childhood learners (2-7 years)	<ul style="list-style-type: none"> - At this stage intuition and language develop. - Examples of instructional tools Piaget would recommend to describe objects they are experiencing include: concrete props, symbols, and visual aids such as drawings, usage of models or examples, lessons about the children's world and their experiences, less paper-and-pencil tasks and more "hands on" learning, back-and-forth conversations with peers to develop skills for the next stage, and field trips.
Children in the elementary school years (7-11 years)	<ul style="list-style-type: none"> - A child's thinking becomes less rigid and more dynamic during this stage. - Huitt (1997) mentions these instructional tools that follow this theory: concrete props such as three dimensional science models, lab work with minimal steps, brief and well organized lectures, relate existing instruction into previously learned material, word problems in math, and problems which require logic and analysis to solve (Huitt & Hummel, 2003). - The Math Forum at Drexel University (2006) explained math education using a Piagetian theory: Students need to construct their own understanding of each mathematical concept, so that the primary role of teaching is not to lecture, explain, or otherwise attempt to 'transfer' mathematical knowledge, but to create situations for students that will foster their making the necessary mental constructions. A critical aspect of the approach is a decomposition of each mathematical concept into developmental steps following a Piagetian theory of knowledge based on observation of, and interviews with, students as they attempt to learn a concept (Ojose, 2008).
The 12 year old and up group	<ul style="list-style-type: none"> - This stage is called the formal operations stage. - Huitt (1997) suggests classroom practices such as these to best use Piaget's theory: concrete operations stage type graphs on a more complicated scale, ask students to explore hypotheticals as they explore other worlds or complicated issues, encourage students to describe opposing viewpoints, have students describe how they solved the problem, teach broad but curriculum related concepts, and use materials and ideas relevant to the students to broaden their perspectives (Huitt & Hummel, 2003).

2.3 The theories of reasoned action and planned behavior

In the early days of attitude research, most investigators accepted as a given that human behavior is guided by social attitudes. In fact, the field of social psychology was originally defined as the scientific study of attitudes (Thomas & Znaniecki, 1918), (Watson, 1925) because it was assumed that attitude was the key to understanding human behavior.

Whereas this first systematic investigation of the attitude–behavior relation started with the assumption that behavior has little to do with attitudes, the second study to examine this issue accepted the proposition that attitudes guide behavior and tried to use a measure of attitude toward cheating to predict actual cheating in the classroom (Corey, 1937).

By the late 1960s, at least 45 separate studies had been reported in which investigators assessed verbal attitudes and observed actual behavior that they expected to be related to the attitudes. Investigators attempted to predict job performance, absenteeism, and turnover from job satisfaction attitudes (e.g., Bernberg, 1952; Vroom, 1964); they looked at attitudes toward African Americans in relation to conformity with the judgments made by African Americans (Himelstein & Moore, 1963), or in relation to willingness to have a picture taken with an African American (De Fleur & Westie, 1958; Linn, 1965); they used attitudes toward cheating in attempts to predict cheating behavior (Corey, 1937; Freeman & Ataoev, 1960), attitudes toward labor unions to predict attendance at labor union meetings (Dean, 1958), attitudes toward participating as a subject in psychological research to predict actual participation (Wicker & Pomazal, 1971), and so forth (Ajzen & Fishbein, *The Influence of Behavior on Attitudes*, 2005).

After conducting his review of relevant studies, Wicker (1969) reached the following conclusion regarding the strength of the attitude–behavior relation: Taken as a whole, these studies suggest that it is considerably more likely that

attitude will be unrelated, or only slightly related to overt behaviors as opposed to being closely related to actions (Ajzen & Fishbein, The Influence of Behavior on Attitudes, 2005).

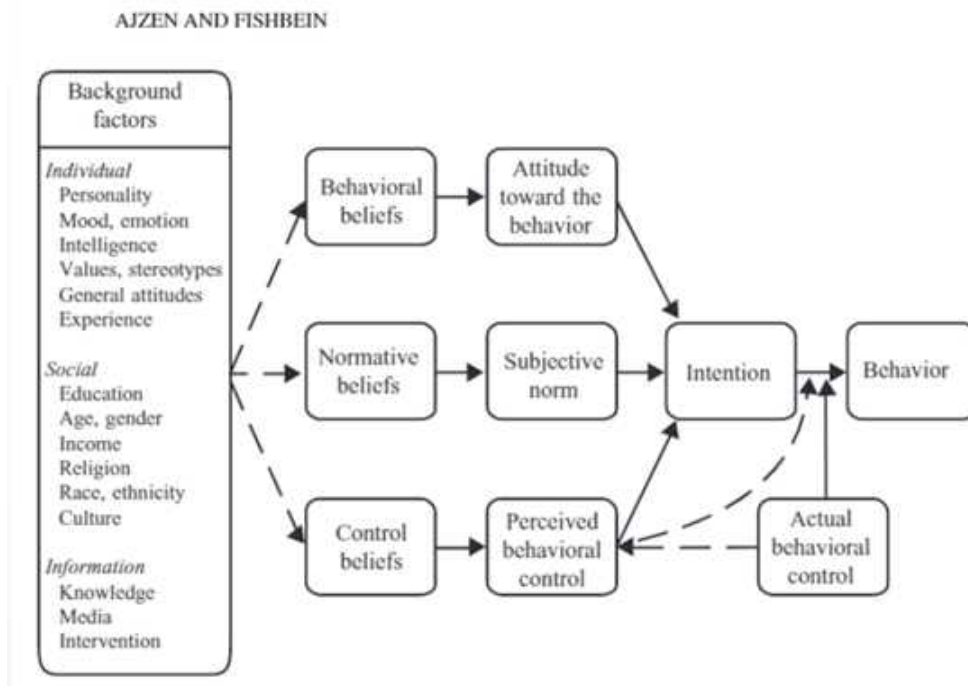


Figure 2-1 Theories of reasoned action and planned behaviour (Ajzen & Fishbein, The Influence of Behavior on Attitudes, 2005).

Figure 2-1 depicts one way how the antecedents of intentions and behavior can be represented (Ajzen, The theory of planned behavior, 1991), (Fishbein, 2000).

Implicit in this model are several fundamental assumptions:

1. Intention is the immediate antecedent of actual behavior.
2. Intention, in turn, is determined by attitude toward the behavior, subjective norm, and perceived behavioral control.

3. These determinants are themselves a function, respectively, of underlying behavioral, normative, and control beliefs.
4. Behavioral, normative, and control beliefs can vary as a function of a wide range of background factors.

2.4 Theory on environmental education

Legislation requiring instruction in the conservation of natural resources at both the elementary and secondary level, and requiring science and social studies teachers to have "adequate preparation" in the conservation of natural resources was passed during the 1930s. Historically, the lack of a comprehensive curriculum planning which has resulted in a series of rather inconsistent and unrelated environmental experiences that focus on limited and incomplete program objectives (Engleson & Yockers, 1994). Wisconsin's historical commitment to education advancing environmental literacy and sustainability is well known. Since 1935, teacher preparation programs must include environmental education. In 1985, Wisconsin adopted a requirement for every school district to develop and implement a kindergarten through grade 12 sequential curriculum plan (Wisconsin State Legislature, Wisconsin State Legislature, 2019), with implementation intended as an interdisciplinary approach, stating that "environmental education objectives and activities shall be integrated into K-12 curriculum plans, with the greatest emphasis in art, health, science and social studies education" (PI 8.01(2)(k)6.b) (Wisconsin State Legislature, Wisconsin State Legislature, 2019) (Evers, 2018).

Education can be improved if we design instruction and education research on the basis of a coherent theory that combines newer concepts from epistemology, psychology, and curriculum theory (Novak, 1980).

Sustainable development can be observed and be impacted by most of the major environmental issues facing human beings on the face of the earth. At the same time, in education, one is beset with numerous statements about and pleas

for the development of an environmentally literate global citizenry (Hungerford, Peyton, Bluhm, & Volk, 1994).

If educators want to develop learners who are both capable of and willing to respond to environmental issues in their communities and nations in ethically responsible ways, two things must happen: (1) The students must feel an ownership of the issue in question, and (2) the students must feel empowered to some-how effect change with respect to that issue (Hungerford, Peyton, Bluhm, & Volk, 1994).

“The Goal of EE: To aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated human beings who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between development and the quality of life and quality of the environment” (Hungerford, Peyton, Bluhm, & Volk, 1994).

This definition suggests two important implications:

- Firstly, the EE must develop skilled problem solvers and,
- Secondly, the EE must be concerned with development and, more importantly, a quality of human life and a quality environment (Hungerford, Peyton, Bluhm, & Volk, 1994).

Goals for Curriculum Development in EE” (and focused on an investigation approach to EE) move hierarchically from science foundations to issue awareness through issue investigation and evaluation to citizenship action (Hungerford, Peyton, Bluhm, & Volk, 1994).

There are still gaps and shortcomings in EE programs both inside and outside the school system, such as: less seems to have been achieved at the secondary level than at the primary level in schools both quantitatively and in terms of innovation. Little has been done for training out-of-school educators or in-service teachers in environmental matters. There are still far too few trained

for the teaching of ecology, or capable of effective participation in a multidisciplinary approach. Last, but most important, there still appears to be a considerable need for developing or refining overall EE strategies in all forms and at all levels of education (Hungerford, Peyton, Bluhm, & Volk, 1994).

The process outlined by Tbilisi (1977) has been prepared primarily to serve as a basis for curriculum development in EE. It does not propose a specific curriculum for EE but, instead, establishes a set of guidelines which are valid for curriculum decision-making in any school, community, region, or nation (Gillett, 1977).

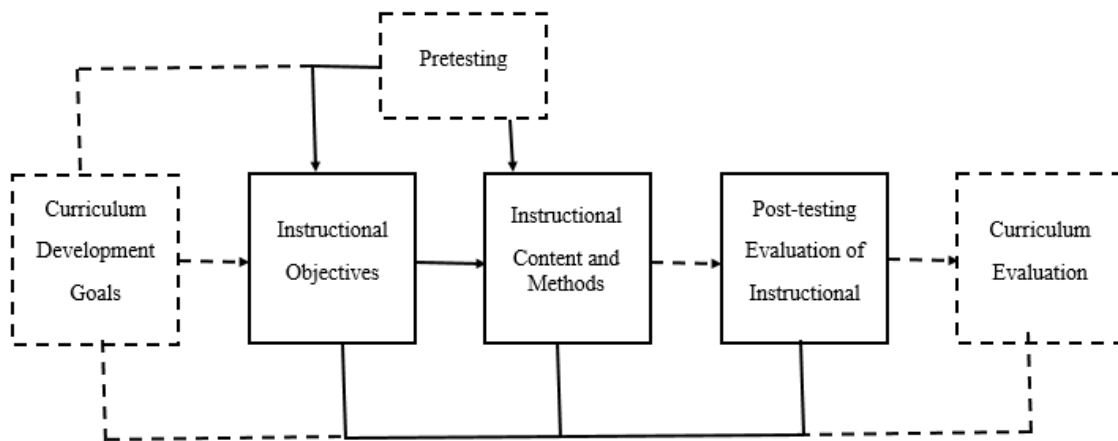


Figure 2-2 Curriculum development and the instructional process (Hungerford, Peyton, Bluhm, & Volk, 1994)

A flow chart of the entire curriculum/implementation/evaluation process is presented in Figure 2-2. This diagram reflects the components of the instructional process plus original curriculum goals and curriculum evaluation. These relationships must be constantly respected in any curriculum development effort in order to guarantee validity (Hungerford, Peyton, Bluhm, & Volk, 1994).

2.5 Expansion of education methods for elementary students

2.5.1 Workshop

Today, EE is playing an important role toward sustainability. EE for young generations has an important impact on training and preparing the future generation for a green society. Children will become the biggest stake in the future, while the world is getting worse with environmental damage, social injustice and appalling ill-health. The society should equip children with the attitudes, values, knowledge and skills necessary to rethink and change current patterns of action and to secure healthy, just and sustainable futures for all (Davis & Cooke, 1998). However, for children in the early childhood years, with the biggest stake in the future, there has been a major absence from curriculum theory, policy and practice of approaches that stress environmental perspectives (Davis J. M., 1998).

In the middle 1980s, many studies confirmed that the application of informal methods of teaching led to better results in the process of learning (Dimitrijević, Filipović, & Stanisavljević, 2016). The theory and background supporting the workshop/presentation approach to professional development is well documented in the K-12 research literature (CALPRO, 2017). Workshops/presentations are one of the few professional development approaches whose impact has been best documented (CALPRO, 2017). Research by Joyce and Showers (1988) show that when the five components theory, demonstration, practice, feedback and coaching are incorporated into training, instructors make gains in their level of knowledge and skills, and transfer what they have learned in the workshop through their own classroom environment.

There are a number of ways to get students involved in EE activities. Participation can be as simple as a class lessons, or as complex as outdoor activities. A workshop is one of the simple techniques to evaluate student knowledge and intention in the classroom. In education, on the one hand it is

necessary to use environmental concepts to teach students how to live better; for this purpose, the level of teaching material should be understandable for all of the students and should also have practical aspects to prepare the students to live a life in accordance with existing technology (Safari & Hosseini, 2016).

2.5.2 Drawing activities

Some of the modernized teaching approaches are informal discussion, concept maps, drawing and more. When drawing, students are given the opportunity to present their mental picture much better than in verbal or written forms (Dempster & Stears, 2013).

Through their drawings students can show what they have learned and what they consider important (Chin & Teou, 2009).

Visual presentation is especially useful for students with literacy disabilities, and, therefore, is particularly suitable for primary school pupils (Chin & Teou, 2009).

Socio-cultural studies in education show that children interact with each other when drawing, as drawing and talking with peers often go hand in hand (Hopperstad, 2008).

Firstly, many scientists believe that this is a powerful instrument that reflects the way of thinking, emotions, internal representation, and perception of students. Secondly, the introduction of this method provides a more pleasant working environment for students, and drawings make it possible for students to communicate with each other. Thirdly, in the early stages of schooling, this is a convenient way to overcome fear related to verbal difficulties. Fourthly, the process of drawing as a multidimensional factor, expresses students' views, understanding and attitudes. Drawing confirms objectivity in the projection of individual beliefs.

Drawing is an even more relevant tool in assessing students' understanding if it is accompanied by a written commentary (Chin & Teou, 2009). Drawing, a more powerful tool of narration, expression, and reflection than the ability young children possess to express with words, is considered to be a reflection of the child's perception of their environment and human relationships (Cherney, Seiwert, Dickey, & Flichtbeil, 2006).

There are numerous studies that analyse the notions that appear in children's drawings, where children want to show their understanding of nature and social phenomena.

Drawings representing plants often also contain atmospheric elements (rain, clouds and the sun) and land. This is associated with conceptual development, i.e. with their understanding that these elements are very important for the life of plants. Based on this we can conclude that children's drawings are very useful as a resource in the evaluation of their conceptual development in childhood, or that they express the connection between the processes of thinking and drawing (Villarroel & Infante, 2014).

2.6 Environmental education practice

2.6.1 Environmental education in Japan

Environmental administration in Japan today is centered at the central government level in the Ministry of the Environment. At the local government level, it is carried out by prefectures and municipalities on the basis of continuing liaison with central government (Ogata, 2008).

The roots of EE in Japan can be traced back to two original fields of education from the early 1950s through the late 1960s; education for nature conservation (conservation education) and pollution education (kogai kyoiku in Japanese) (Imamura, 2017).

Since the 2000s, schools in Japan have developed diverse approaches to EE based on the characteristics of each region. During the 2010s, the notion of "environmental education incorporating the viewpoints of ESD" has many good results. This is education that focuses on comprehensive issues such as: environment, industry, culture, history, welfare, etc., and links them with many stakeholder like government, NPO, company, communities, etc. in order to consider the sustainability of different regions. The National Curriculum Standards which will be enacted from 2020 incorporate the viewpoints of ESD. (Kodama, 2017).

EE in schools is officially defined in “Kankyōkyōiku shidōshiryō” (Teacher’s guide for EE). This guide was published in 1991 by the Ministry of Education at that time for elementary (1st edition), junior high, and high schools and by the National Institute for Educational Policy Research only for elementary schools in 2007 (2nd edition) and 2014 (3rd edition) (Kodama, 2017).

In the first edition, EE was defined as “education that engages in solving global environmental issues;” this became significantly noticeable during the 1990s (Ministry of Education 1992, pp.7-8). In the second and third editions, it was defined as “environmental education for a sustainable society”, it was defined as “environmental education for a sustainable society” with the aim of achieving a balanced development of environment, economy, society, and culture (Center for Curriculum, National Institute for Educational Policy Research 2007, pp.3-7, National Institute for Educational Policy Research 2014, pp.3-5) (Kodama, 2017). The objective of the Japanese policy (2014) was to develop the link between a lower grade of elementary school and preschool in order to promote EE (NIER, 2018).

Pollution education (PE) is viewed as being original EE in Japan. The practice of PE became popularized at Japanese schools and the term “environmental education” gradually and consistently came into use in Japan. As

is well known, PE was not institutionalized education and has been misunderstood as anti-industrial (Kodama, 2017). Recently, Japanese teachers' pay attention to ESD more than PE.

In the Japanese educational system, there is no subject called "environmental education." It is the subjects that have an EE viewpoint in the school textbook and curriculum of each school. The textbooks on science, social studies, and home economics already include the concepts of the ecosystem, energy, and consumption behavior (Kodama, 2017). The textbooks on Japanese language and moral education also include literary works on environmental conservation and protection of nature, which contribute to raising students' environmental consciousness (Kodama, 2017). The period for integrated study (PIS), which is conducted from the 1st grade to 9th grade, for 1st and 2nd grade students. The EE in Japanese schools in general has set "beautification and cleaning," "breeding and production," and "waste and recycling" as the core subject matters.

The national plan for the Global Action Program on Education for Sustainable Development (GAP-ESD) was launched in March 2016, and Japan has been one of the leading countries to implement GAP-ESD since then. As one of its advocates, Japan has been taking a holistic approach to the advancement of ESD by collaborating with public, civil, and private sectors as well as local schools and communities (The Ministry of Education, 2019).

2.6.2 Environmental education in Southeast Asia

Southeast Asia, as referred here, embraces the 10 countries of the Association of Southeast Asian Nations (ASEAN) that includes Vietnam. Although the environments are diverse, a large part of the sub region lies within the tropics. Rapid economic growth in the 1970s and 1980s has made Southeast Asia the most populous and developed part of the tropics in the world (Brookfield, 1993) with megacities and intensively used agricultural land.

Environmental issues are omnipresent in Southeast Asia. Southeast Asia has continued to experience economic growth since the 1980s, driven by the expansion of direct investment from other countries. However, this growth has also brought with it a host of environmental issues, including deforestation, air pollution, and water pollution (Kojima, 2016).

Education has been identified as a critical driving force for change in the Asian and Pacific Region, and countries and regional organizations have adopted a range of strategies for implementing the EE program (UNFPA, 2017). In Southeast Asia, the misleading message of data for the number of children attending schools, the number of new school buildings and the contents of textbooks were made a big issue to quantitatively measure the ability to provide environment courses for the Jomtien Declaration 1990 in Thailand and Dakar Framework for Action 2000 in Bangladesh (Chandran & Gunawardena, 2017). Environmental issues in Southeast Asia associated threats to human health.

Table 2-2 showed the summary of some of the EE pilot project in Southeast Asia countries.

Table 2-2 Summary of EE pilot project in Southeast Asia

Indonesia	
Pilot project at Jakarta city, Semarang, Surabaya, Bandung (Development Alternatives Inc (DAI), 2006)	<ul style="list-style-type: none"> - <i>Social and environmental status and issues:</i> <ul style="list-style-type: none"> • GDP growth rate: 5.5% (2015) • Urbanization: 44.3% (2010) • Rate of consumption • Law and enforcement • Budgets • Public objections • Efforts for large-area policy discussion • Financial - <i>Project stakeholders:</i> <ul style="list-style-type: none"> • Communities - <i>Project instruments:</i> <ul style="list-style-type: none"> • Education activities for citizens • Questionnaires • Efforts for large-area policy discussion

	<ul style="list-style-type: none"> - <i>Project targets:</i> <ul style="list-style-type: none"> • To improve the garbage disposal system in Central Jakarta • To reduce waste • To extend landfill life • To increase waste collection • To reduce emission of greenhouse gases
<i>Thailand</i>	
Pilot project at Sakonnakorn province, Bangkok	<ul style="list-style-type: none"> - <i>Social and environmental status and issues:</i> <ul style="list-style-type: none"> • GDP growth rate: 3.6% (2015) • Urbanization: 34.0% (2012) • Rate of consumption • Law and enforcement • Budgets • Public objections - <i>Project stakeholders:</i> <ul style="list-style-type: none"> • Students • Communities - <i>Project instruments:</i> <ul style="list-style-type: none"> • Questionnaires • Reduction and recycling activity • Training programs and practical guidelines • Provision of clear procedures and guidelines • Regular town hall meetings between citizens and local government officials - <i>Project targets:</i> <ul style="list-style-type: none"> • Waste reduction • Cost savings for management • Extending landfill life supply-side management
Eco-school project in Bangkok, Samut Prakarn, Nonthaburi and Phuket (Andreou, 2018)	<ul style="list-style-type: none"> - <i>Project stakeholders:</i> <ul style="list-style-type: none"> • 21 schools - <i>Project instruments:</i> <ul style="list-style-type: none"> • Outdoor learning • Experience a sense of achievement - <i>Project targets:</i> <ul style="list-style-type: none"> • Raising awareness and understanding on environment issues through observation and learn how these issues relate to students' everyday life
<i>The Philippines</i>	
Pilot project at the University of the	<ul style="list-style-type: none"> - <i>Social and environmental status and issues:</i> <ul style="list-style-type: none"> • GDP growth rate: 6.4% (2015) • Urbanization: 48.9% (2010) • Rate of consumption

Philippines (Marquardt, 2010)	<ul style="list-style-type: none"> • Law and enforcement • Budgets • Public objections • Landfill problems • Solid waste management problem <ul style="list-style-type: none"> - <i>Project stakeholders:</i> <ul style="list-style-type: none"> • Children of all ages • Teenagers • Household help • Parents • The elderly - <i>Project instruments:</i> <ul style="list-style-type: none"> • Questionnaires • Seminar tests • Attitude scales • Interview guides - <i>Project targets:</i> <ul style="list-style-type: none"> • Developing the knowledge, skills, and attitudes of the members of the community towards proper handling of waste
Malaysia	
Pilot project of a university in Malaysia (Asmawati, Nor Ba'yah, & Fatimah, 2012)	<ul style="list-style-type: none"> - <i>Social and environmental status and issues:</i> <ul style="list-style-type: none"> • GDP growth rate: 4.7% (2015) • Urbanization: 72.2% (2010) • Rate of consumption • Law and enforcement • Budgets • Public objections • Landfill problems <ul style="list-style-type: none"> - <i>Project stakeholders:</i> <ul style="list-style-type: none"> • Office staffs • Students • Lecturers • Hostel operators • Canteen operators • Building custodians • Outdoor cleaning and landscape workers • Security guards - <i>Project instruments:</i> <ul style="list-style-type: none"> • Two-hour training of solid waste management on the university campus • Zero Waste Club: Participation in collection and recycling in

	<p>campaigns and activities associated with zero-waste activities</p> <ul style="list-style-type: none"> • Position for providing strong leadership and examples for the development of sustainable communities, by conducting programs for future leaders <ul style="list-style-type: none"> - <i>Project targets:</i> • Reducing waste production • Increasing and maintaining participation in recycling and composting schemes within the university • Raising and maintaining awareness of waste issues • Promoting the waste hierarchy: reduce, reuse, recycle • Providing a diverse range of ways to increase education and awareness • Consistent publicity • Linkage of regional and national campaigns
--	--

2.6.3 Environmental education for elementary students in Vietnam

Vietnam achieved universal primary education in 2000 and has been promoting the universalization of early childhood care and education (ECCE) for children at the age of 5, and universal primary education at the right age. Some parts of the country have universal secondary education.

Primary education in Vietnam consists of five grades, starting with 6-year-old children. Therefore, children will, without repeating, complete primary schools at the age of eleven. In Vietnam, many students only attend a half-day of school, because of a shortage of teachers, classrooms and teaching-learning materials and resources.

In the current primary school curriculum, children in grades 1-3 should study 6 subjects: Vietnamese language, Mathematics, Natural and Social Sciences, Moral Education (civics), Physical Education, and Arts. While only Vietnamese language and Mathematics have textbooks for the student's use; the remaining subjects have teacher's guides for the teacher's use. Children in grades 4-5 have to learn 7 subjects: Vietnamese language, Mathematics, History and Geography, Sciences, Moral Education (civics), Physical Education, and Arts. In these grades the four subjects Vietnamese language, Mathematics,

History and Geography, and Sciences have pupils' textbooks, while the remaining subjects have teacher's guides. In Vietnam, textbooks play a crucial role in pedagogical practice. There is only one textbook set for each level of education, and it is published by Vietnam Education Publishing House (Nguyen T. P., 2019).

In the 2004-2005 school year, Vietnam had 14,518 primary schools and 1,034 combined primary and lower secondary schools. The total number of primary students in the 2004-2005 school years was 7,773,484.

Table 2-3 shows the weekly lesson timetable for elementary students in Vietnam. Each teaching period lasts about 35 minutes. Health education is integrated into natural and social studies in 1st – 3rd grade, and into science in 4th and 5th grades. From 1st to 3rd grade, the subject 'Arts' includes music, drawing and technology/handicraft. Some schools offer foreign languages and informatics (optional subjects), two periods per week in 4th and 5th grades.

Table 2-3 Primary education: weekly lesson timetable (national guide lines)

Subject	Number of weekly period in each grade				
	1 st	2 nd	3 rd	4 th	5 th
Vietnamese language	11	10	9	8	8
Second language	0	0	3	3	3
Mathematics	4	5	5	5	5
Moral education (Ethic)	2	2	2	1	1
Natural and social studies	1	1	2	2	2
Science	0	0	0	2	2
History and geography	0	0	0	2	2
Arts	3	3	3	0	0
Music	1	1	1	1	1
Drawing	1	1	1	1	1
Technology/Handicraft	1	1	1	3	3
Physical education	2	2	2	2	2
Other activities	3	3	2	2	2
Total weekly periods	29	29	31	32	32

*Source: the Ministry of Education and Training, 2017 (the Ministry of Education and Training, 2017)

Vietnamese children attend schools within a system that is largely divided into two types: (a) Public schools, and (b) Private schools (Ministry of Education and Training, Vietnam 2014). The Ministry of Education and Training integrated some basic knowledge about environment education in many lessons, such as: history and geography, science and moral education (civics).

Table 2-4 Vietnamese elementary guide book curriculum

Grade	Subject	Lesson	Related
1	2	9	Clean school and class, plants, animals
2	2	10	Naturals, protect environment
3	2	21	Protect naturals, save and protect water, save and protect environment
4	4	11	Water pollution, air pollution, typhoon protection, protect environment
5	4	15	Natural energy, saving energy, natural resources, soil pollution, forest protection

Vietnam has experienced increased levels of environmental pollution in line with rapid socioeconomic development and urbanization in recent years. In response to this situation, the government passed amendments to the Law on Environmental Protection (January 10, 1994) on July 1, 2006, adopting the prime minister's decision on August 17, 2004 known as "Vietnam Agenda 21" which aims at sustainable development. Within this environmental protection policy, the "3R Initiative" of reduce-reuse-recycle was raised as an important subject in need of immediate attention. There are growing needs in MSW education for children in developing economies in Southeast Asia. However, MSW education for young children is limited in its application in most countries in this region. In particular, education for solid waste treatment is rarely done in elementary schools in Vietnam.

From July 2006 to July 2009, Ha Noi city, Vietnam cooperated with JICA, Japan on project “3R (Reduce, Reuse, Recycle) Initiative in Hanoi City to Contribute to the Development of a Sound Material-Cycle Society” for source segregation/discharge practice of biodegradable waste. Ha Noi before 2008, area: 921 km² and a population of 3 million generating 1.0 kg-solid waste/person/day (2004); had a waste collection rate of about 70%, a reuse and recycling rate of approximately 20%, and approximately 7% of the total amount of waste was composted (JICA, Annual Report 2006, 2006). The uncollected solid waste on public roadsides and illegal disposal of waste into lakes and marshes, water conditions are poor and groundwater contaminations were occurred. Ha Noi city is aiming at promoting a solid waste recycling campaign under the national environmental strategy of recycling 30% of all domestic waste by 2020. To raise awareness of residents in project areas, environmental education related 3R in schools and public awareness program in communities were implemented in total 8 schools. “3R Volunteer Club”, consisting high school and university student volunteers, was established in December 2007 and promoted and disseminated 3R activities in Ha Noi city. The Project has succeeded in involving a variety of stakeholders in the process of implementing the pilot project with source separation, composting, environmental education and raising awareness for citizens. Because of the lack in collection systems and educational programs, the 3Rs project in Ha Noi city stopped and has not yet been applied in another city (Taniguchi & Yoshida, 2011).

2.7 Lessons learned

The focus of this chapter was on the theoretical considerations underlying the present study. There were four fields identified and discussed.

This chapter includes a discussion in section 2.2 Characteristics of Childhood Development. This chapter was considered as vital in finding subjects of the study. At the onset, the study wants to understand characteristics of

students according to their ages. The study focused on 4th and 5th grade student at elementary school.

Section 2.3, the theories of reasoned action and planned behavior. This study aims to create and develop the model to estimate the impacts to student intention and behavior when they participate on EE.

The third was a discussion on section 2.4 Theory on EE, section 2.5.1 Workshop and section 2.5.2 Drawing activities. These sections combine to create and develop EE for elementary students in this study. The discussion on EE showed that different approaches can be used to include EE in the school curriculum. This study chose workshop activities to develop EE for elementary students in Da Nang, Vietnam. Together with an educational method, the study paid attention to the evaluation method. The created newspaper appeared in workshop education, so the study did some research about how to analyse pictures drawn in the student newspapers.

The fourth was to summarize information on section 2.6 EE practice in Japan, Southeast Asia and Vietnam. According to the Japanese EE example and experience from activities conducted in Southeast Asia, the study created and developed EE activities for elementary students in Da Nang, Vietnam.

Chapter 3 ONE-TIME ENVIRONMENTAL EDUCATION

3.1 Introduction

B.1 Develop one-time education course: The main purpose of this chapter was to develop a one-time education course in Da Nang elementary school with objectives:

- To improve student knowledge in solid waste management and,
- To create separation waste activities.

C.1 Develop evaluation method

- Applied control and treatment design to measure the impact of EE from the study.
- Evaluate the impact of with/out game design for separation waste activities on students. In addition, the study selected 3 elementary schools where 1 school applied EE activities and 2 schools did not have EE. We wanted to measure the effect of EE activities on elementary students.

C.2 Measurement of the impacts of EE from the textbook

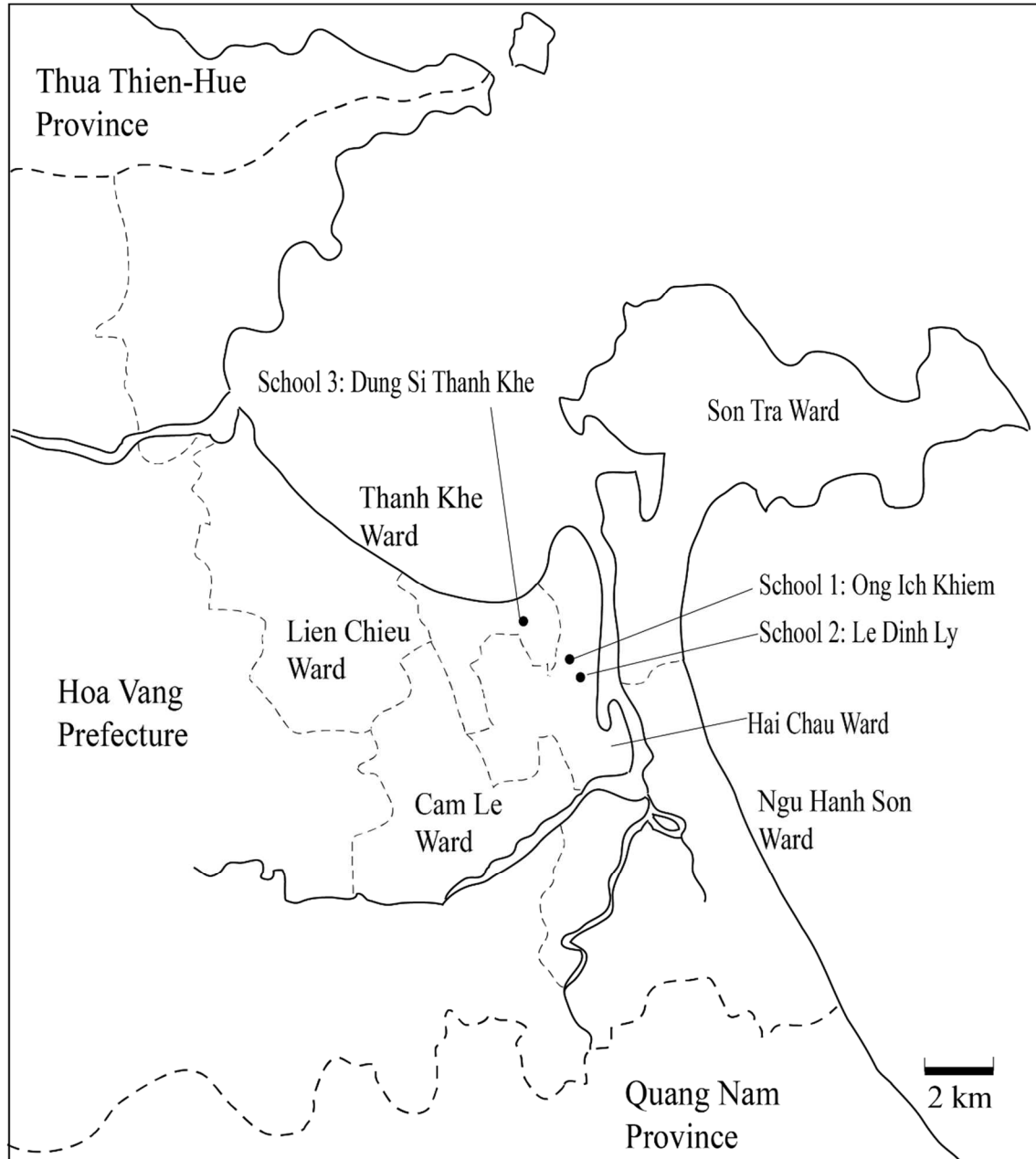
- Summarize EE contents in the national elementary textbook.
- Create a questionnaire survey following the textbook contents. The study prepared a questionnaire survey before and after EE in schools to assess student's understanding.

C.3 Evaluation of one-time education

- Create a questionnaire survey to evaluate student knowledge before and after EE. After 3 months of EE activities the survey was conducted. This was done to measure the attention span of student during EE activities.
- Compare student knowledge with with/out game design.
- The study provides a check-list scale to evaluate student intention to EE from the author.

3.2 Methodology

3.2.1 School selection



* Copyright credit “Map data: OpenStreetMap”

Figure 3-1 Location of school surveyed

I surveyed elementary students in three schools in two big districts of Da Nang city. We chose Hai Chau District (HC) and Thanh Khe District (TK) as the

study sites; Figure 3-1 shows the locations of these districts. I chose HC because, among Da Nang citizens, it is well known as the biggest district in Da Nang city. TK is farther than HC from the city centre, but this is the second biggest district in Da Nang city. Table 3-1 shows the demographics of the two districts. (School 3 only participated in survey 2 and survey 4).

Table 3-1 Information about Hai Chau and Thanh Khe district in Da Nang city, Vietnam

	Hai Chau District	Thanh Khe District
1.Area	21,35Km ² (1,66%)	9,36 Km ² (0.73%)
2. Population (31/12/2010)	197.922 (21,17%)	179.810 (19,3%)
3. Pop. Density (2010)	9.184,92Km ²	19.064,85/Km ²

I chose 4 classes from the 4th grade and 2 classes from the 5th grade at Ong Ich Khiem (school 1) that is located in HC, and 4 classes from the 4th grade and 1 class from the 5th grade in Dung Si Thanh Khe (school 2). I followed these groups of students for the entirety of my research.

3.2.2 EE activities and questionnaire survey design

There were four separate questionnaire surveys to our study as Figure 3-2 shows. I did a questionnaire survey to 2 groups of student in 2 elementary schools. Group 1 was 4th grade students and group 2 was 5th grade students. The 4th grade students participated in 4 surveys comprising 1, 2, 3 and 4, from 2014) until 2015), and they became the main subjects of this research. The 4th grade students became 5th grade student in August 2014, and the 5th grade students graduated from elementary school at the same time. From 2015, there were only 4th grade students who were the main subjects of this research.

Table 3-2 Number of student engaged in one-time EE

	School 1 (treatment school)		School 2 (control school)		School 3 (control school)	
	4 th grade	5 th grade	4 th grade	5 th grade	4 th grade	5 th grade
Survey 1	98	91	60	62	143	40
Survey 2	164	115	66	60	144	43
Survey 3	-	192	-	135	-	159
Survey 4	-	192	-	-	-	151

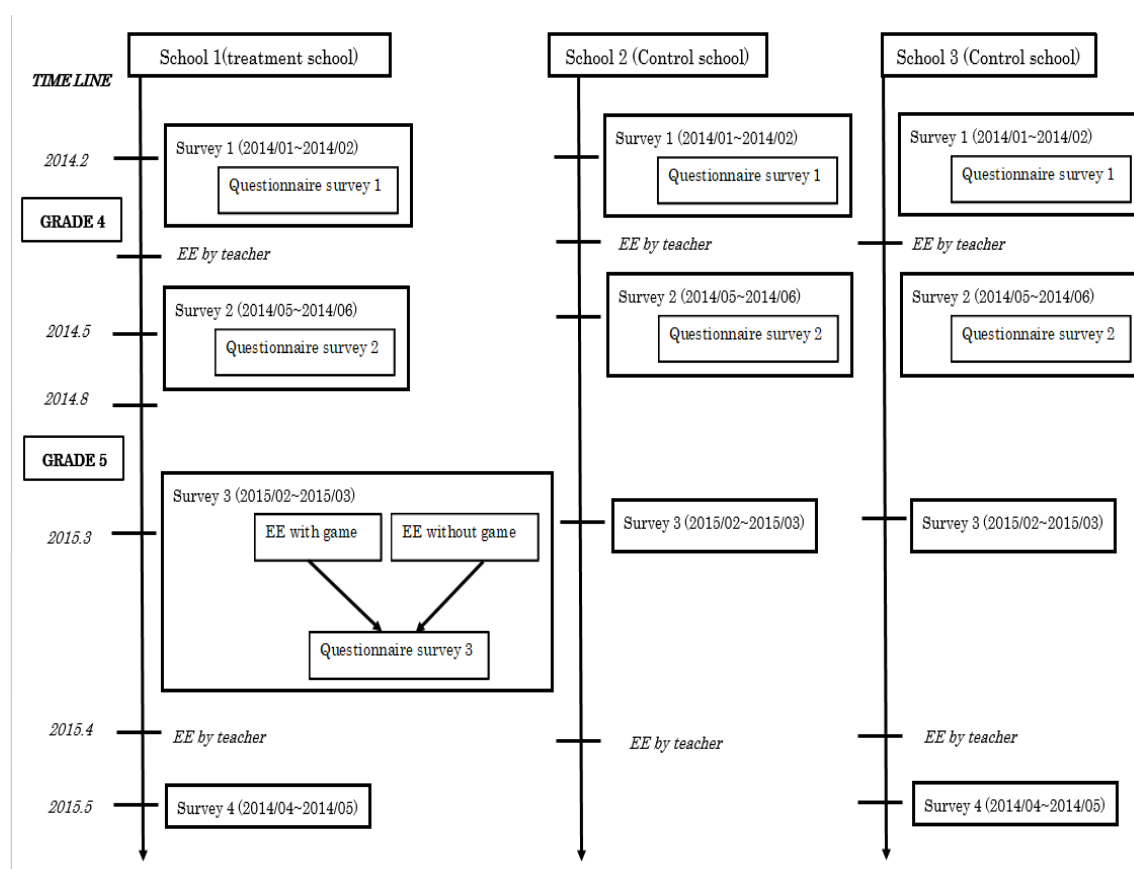


Figure 3-2 Research structure

First survey from Jan. 22 to Feb. 4, 2014: Aims to know the present status of EE for elementary students in the Da Nang city, Vietnam. To achieve this step, I did survey 1 from Jan 22 to Feb 4, 2014 which involved a total of 372 students from 4th and 5th grades. Students answered 32 questions from my questionnaire survey 1, and continued to be subjected to our behaviour observation for the subsequent survey 2 from 19 to 30 May, 2014.

Second survey in May 2014 (Day: 19th to 30th): Aims to evaluate the impacts of experimental EE by comparing knowledge levels of the same students before and after the education lesson from the school. I measured the baseline knowledge level of the 4th grade students in two schools during survey 2. In addition, I observed student activities in the school to check student answers from survey 1.

Third survey in March 2015 (Day: 2th to 18th): My environmental activities in March 2015, provided opportunities for these students to: (1) join a garbage separation game, (2) learn the present status of voluntary food residue recycling in Da Nang city, and (3) answer our questionnaire survey 3 to assesses the impacts of the EE. I randomly separated the classes of the 4th grade students in surveys 1 and 2 (2015 they went to 5th grade) into treatment groups where treatment group 1 had an activity with a game and, treatment group 2 had an activity without a game. I presented the same education, at the same time and knowledge level for students. I evaluated the improvement of knowledge from the baseline among the 2 treatment groups using 2 ways of with/out a game.

Figure 3-3 shows the contents of our environmental activities for elementary students in Da Nang city. At the beginning, posters gave students some basic information about solid waste management in the city. Those posters gave basic knowledge about organic waste, non – organic waste, and recyclable or reusable waste. In addition, we designed some information about food waste systems, and eco-bag systems in Da Nang city. Finally, in the content of our poster we included some information about the 3Rs concept.

I designed the poster to become notebook cover for students, and I gave it to students who liked the present material in my environmental activities. I hope that students can keep the notebook to remember what they learned.

In addition, I prepared some real waste materials for student. I bought some samples of eco-bag from super market in Da Nang city to show students.



Figure 3-3 Content of our environmental education

Figure 3-4 is the time schedule of our environmental activities in elementary schools. I used 30 minutes to conduct activities with students. I separated students into 2 treatment groups. Treatment group 1 – group with a game, treatment group 2 – group without a game. For group 1, I did 10-minute games at the beginning for students. For group 2, I spoke for 10 minutes about typhoon protection with students. In addition, I separated students in the class into 8 groups of around 6 students/groups. After the environmental activities in the class, I gave an “interest check list” for the students to evaluate their interest

in our activities. Two days after our activities, I gave the student questionnaire survey 3 to evaluate the effectiveness of our activities.

Timeline [↕] (Minutes) [↕]	Treatment 1 [↕]	Treatment 2 [↕]
1 [↕]	Greeting [↕]	
6 [↕]	Make group [↕] - 1 group: 6 students (1 class: ~8 groups) [↕]	
20 [↕]	Short speak about typhoon [↕]	Environment game [↕] - We will make 10 cards about waste (5 cards are organic waste, 5 cards are non – organic waste). [↕] - Group student will separate cards to dust box (organic and non - organic waste) [↕] - We will tell student how many card are they put in right dust box. [↕]
25 [↕]	Environmental education about solid waste management [↕] - We will make teaching material in A0. We will do the same teaching for students. [↕]	
30 [↕]	Break time [↕]	
	Question time, clean up class and answer check list about activities [↕]	

Figure 3-4 Environmental education schedule

- Game details:

- (1) I made 10 cards where 5 represented organic waste and 5 represented non-organic waste.
- (2) I asked students to divide and place the cards into 2 boxes (box 1: organic waste, box 2: non- organic waste).
- (3) After 2 minutes, I collected the results from the students.
- (4) My assistant helped me to count the answers.
- (5) I showed the student the number of correct answers/10 questions.

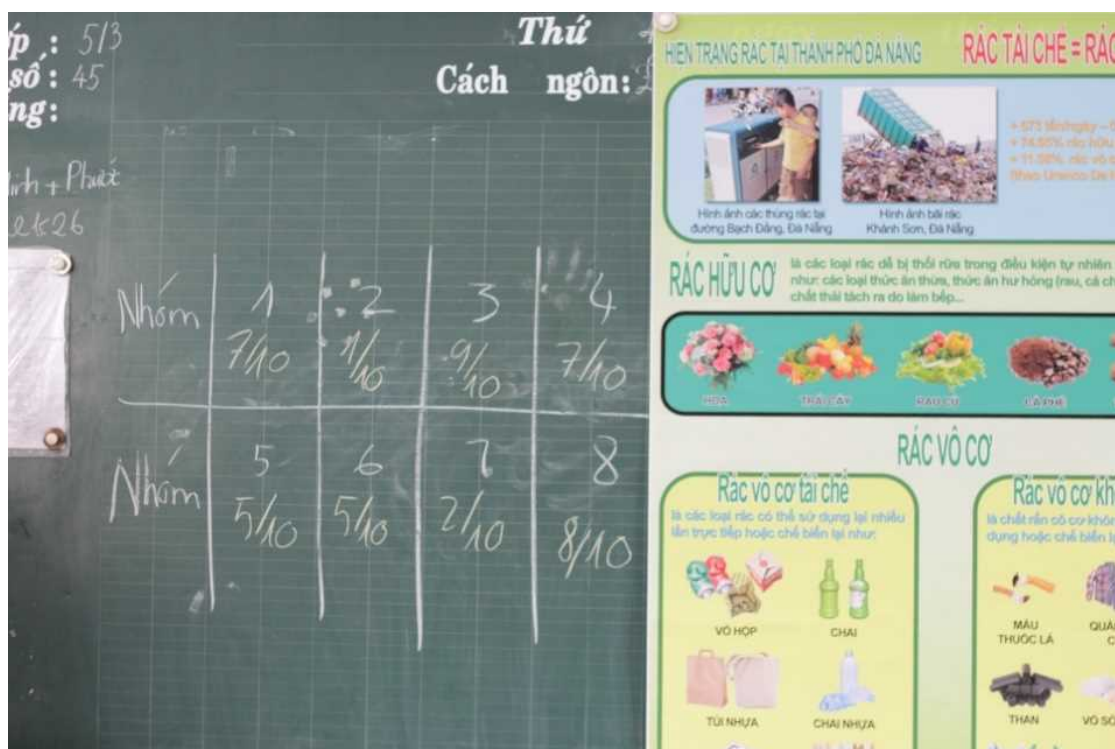


Figure 3-5 Result from game activities

- Typhoon presentation details:

- (1) I made a poster containing information about typhoons.
- (2) I asked the students some questions about typhoons in Da Nang city.
 - How many typhoons are there in Da Nang city/year?
 - How can we protect ourselves during/from typhoons?
- (3) Student answer following their group.
- (4) I showed students my poster.

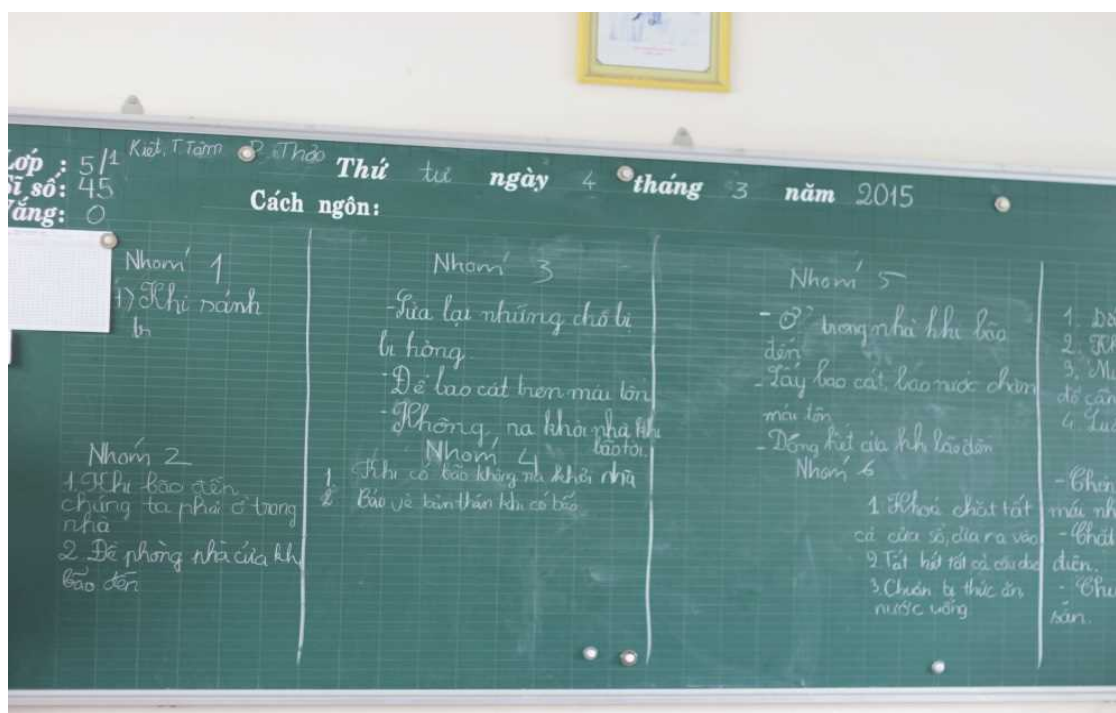


Figure 3-6 Result from non - game activities

Fourth survey in May 2015: Aims to evaluate the long impacts of EE by comparing knowledge levels of the same students before and after our activities at survey 3 from 2 – 18 March 2015. I measured the level of knowledge for 5th grade students 2 months after we conducted environmental activities at the school. Additionally, we did a comparison between students who had environment activities and students who did not participate in environmental activities presented by us.

3.3 Result

3.3.1 Student's basic environmental knowledge and their environmental protection behaviour:

Table 3-3 summarizes the number of total students engaged in our survey. Students entered our survey when they were in the 4th grade in 2014. They continued to participate in our survey when they became 5th grade students. In Vietnam, elementary school ends at the 5th grade.

Table 3-3 Number of student attend our survey from 2014 to 2015

Survey	Number of 4th grade student	Number of student in surveys 1-4
1	250	247
2	278	
3	309	
4	310	

Table 3-4 shows student behaviour when they throw away garbage in school, public area, and at their house. More than 97% answered that they threw garbage in a dustbin. So we can see that students have a good understanding about where they can throw garbage.

Table 3-4 Behaviour of student when they throw away garbage

School	Number	Percent
In drawer under the table	0	0.00%
Dustbin	363	97.58%
In the class	0	0.00%
In the yard	0	0.00%
No reply	9	2.42%
Public area	Number	Percent
Anywhere	0	0.00%
Dustbin	367	98.66%
Place where nobody can't see	0	0.00%
No reply	5	1.34%
House	Number	Percent
Anywhere	0	0.00%
Dustbin	366	98.39%
In your room	0	0.00%
No reply	6	1.61%

Figure 3-7 showed student's basic knowledge about the environment that we estimated from survey 1. As we can see, students had basic knowledge about the environment was air pollution (84%), water pollution (71%), and protect forest (81%). But the chart showed that students had limited knowledge about eco – bags (23%) and garbage recycling (3%).

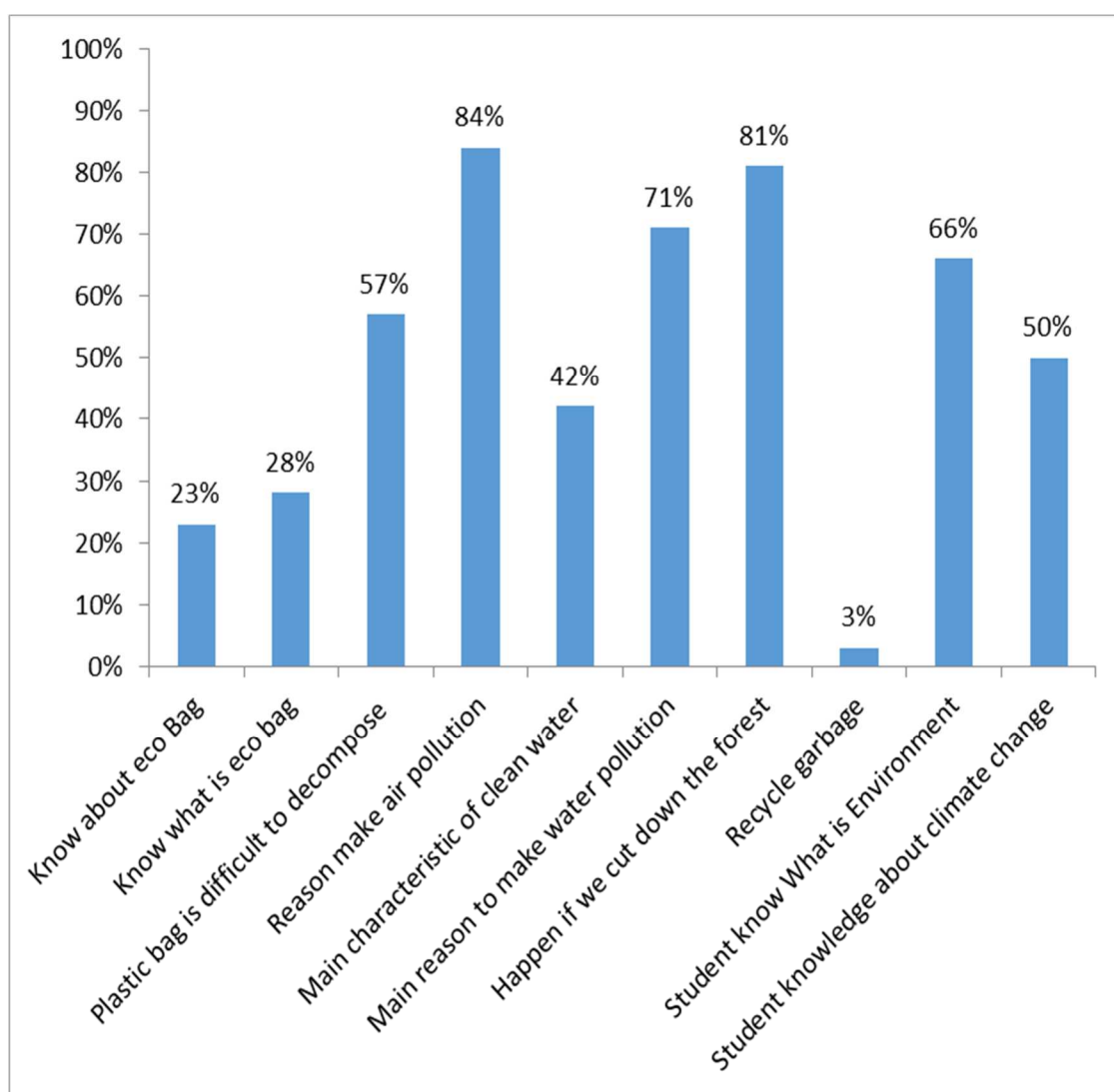


Figure 3-7 Student basic knowledge about environment

Figure 3-8 showed students' thoughts on how they can protect the environment. This chart was prepared from students' answers. Most students think that they can protect the environment if they throw waste in the right place (28%), or take care and plant a tree (40%). As we can see in the chart below, even if student's thought is to throw waste in the right place, they can help protect the environment but they still did not care about "separate waste" activity. Just 10% of the students cared about separating waste when they throw it away.

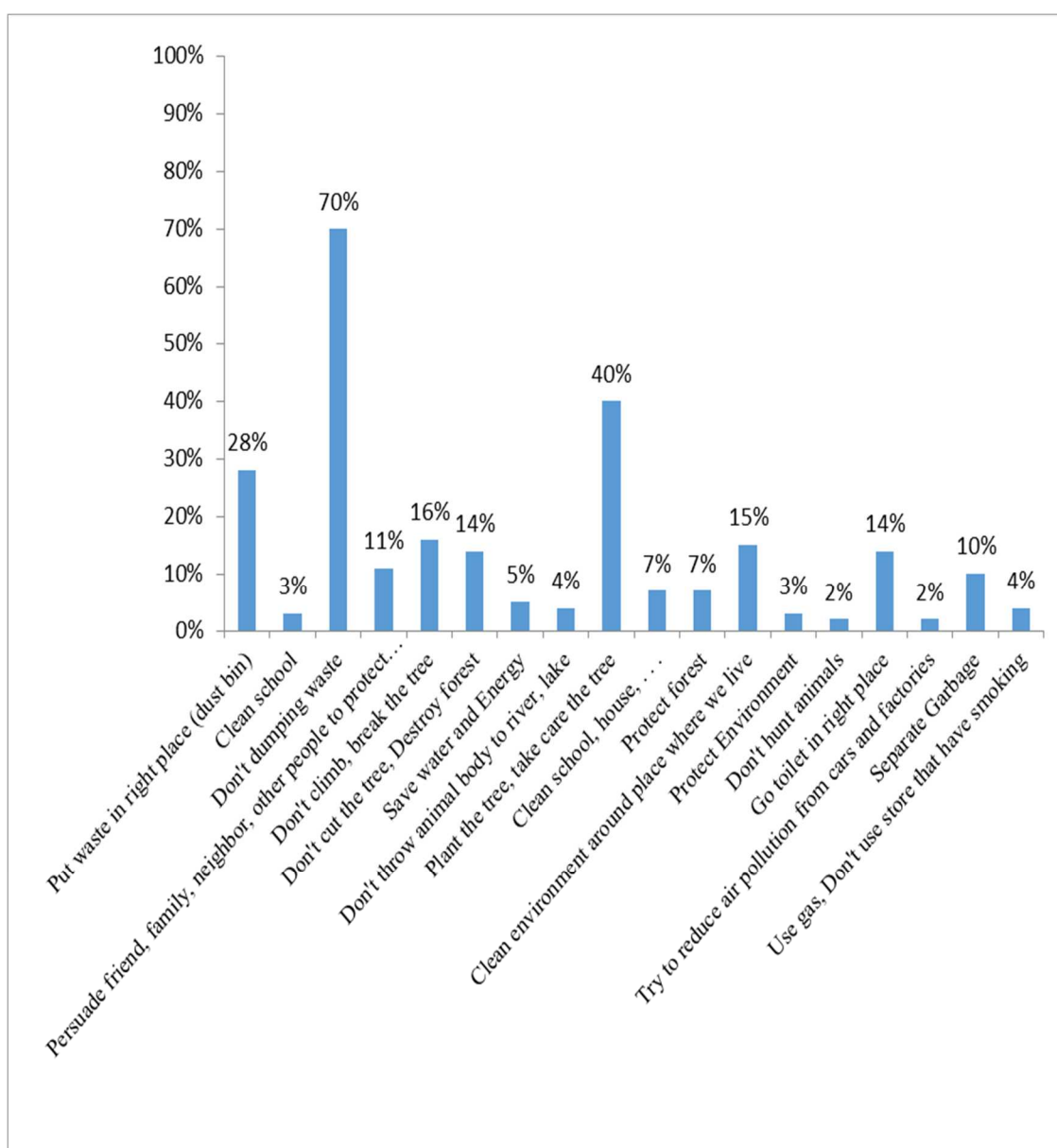


Figure 3-8 Student thinking how they can protect environment

3.3.2 Effect of environmental lesson by school:

I evaluated the environmental lesson done by the teacher in some elementary schools in Vietnam.

In survey 1, we summarized the amount of time that students study. The time used to study at school and at home was around 44% for students who used less than 6 hours/day for study. Those who studied for more than 10 hours/day were 13%. Figure 3-9 showed time that students spent studying. Between survey

1 and survey 2, students got environmental lessons from their teachers. We asked the same question in surveys 1 and 2 to evaluate students' knowledge before and after the environmental lesson from their schools. We found that the time for study didn't have an effect on the students in terms of improvements after the lesson. The student groups studying more than 8 hours per day and for less than 8 hours per day improved their environmental knowledge after the lesson. We found that the environmental lesson from the school had a good impact on students. Figure 3-11 showed student knowledge about the environment before and after the environmental lesson in school. To evaluate student knowledge, we provided 5 questions that included environmental knowledge from the Vietnamese textbook. Figure 3-10 showed the questions used to measure the change in student knowledge before and after EE at school. We used the chi-square tests to examine if environmental lessons in school improved student knowledge. We found that EE lessons from the school increased student knowledge.

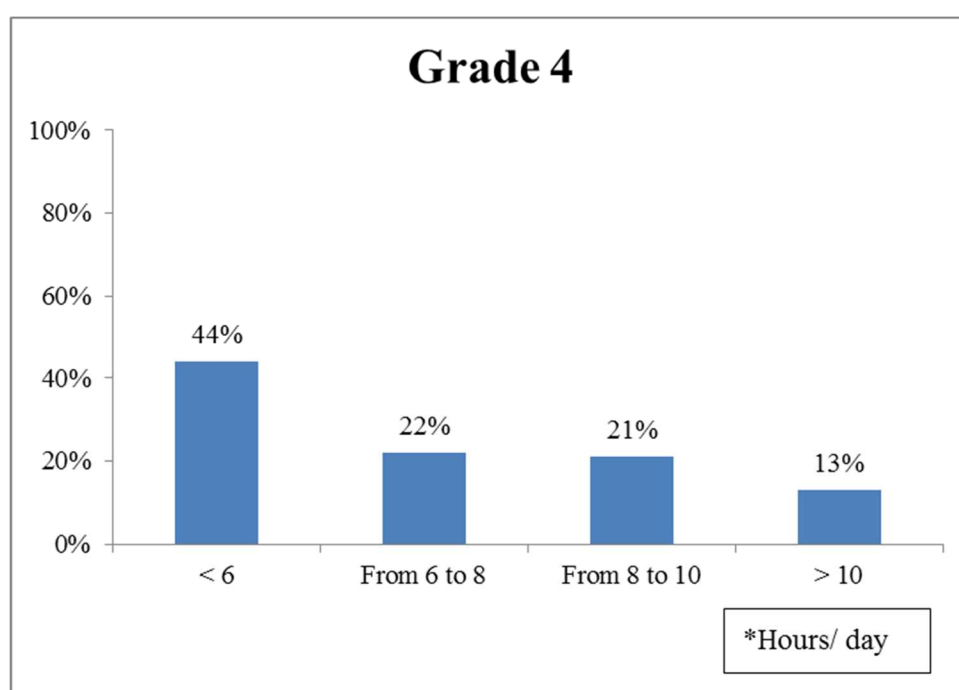


Figure 3-9 Study time of student

III. Environmental knowledge questions: (Soil, water, air, forest)

16. What are reason that make soil pollution? You can choose many answers.

☐ Waste

☐ Demand of place for live

☐ Human use chemical fertilizers in agriculture

☐ I don't know

17. What happens if the air have many toxic gases?

☐ Heavy dusty air

☐ Air pollution

☐ Air move

☐ Air fly higher

☐ I don't know

18. What is main characteristic of clean water?

☐ Easy to drink

☐ Cook delicious foods

☐ Prevent digestive diseases, skin diseases...

☐ I don't know

19. What is main reason to make water pollution?

☐ Animal

☐ Waste

☐ Sun shine

☐ I don't know

20. What happen if we cut down the forest? You can choose many answers

☐ Climate change, flooding...

☐ Decrease number of animal in the forest

☐ Nothing change

☐ I don't know

Underlined options are assumed to be the correct answers.

Figure 3-10 Environmental knowledge assessment questions for students



Figure 3-11 Student knowledge about the environment before and after environmental lesson in school

Figure 3-12 shows changes of student knowledge from the environmental lesson after 1 year. Students studied about air pollution and water pollution when they were in 4th grade. We can see that their understanding about these 2 areas was high at survey 2, but after 1 year their knowledge decrease. Students increased their knowledge in soil pollution area and protect forest, because they studied these 2 topics in 5th grade.

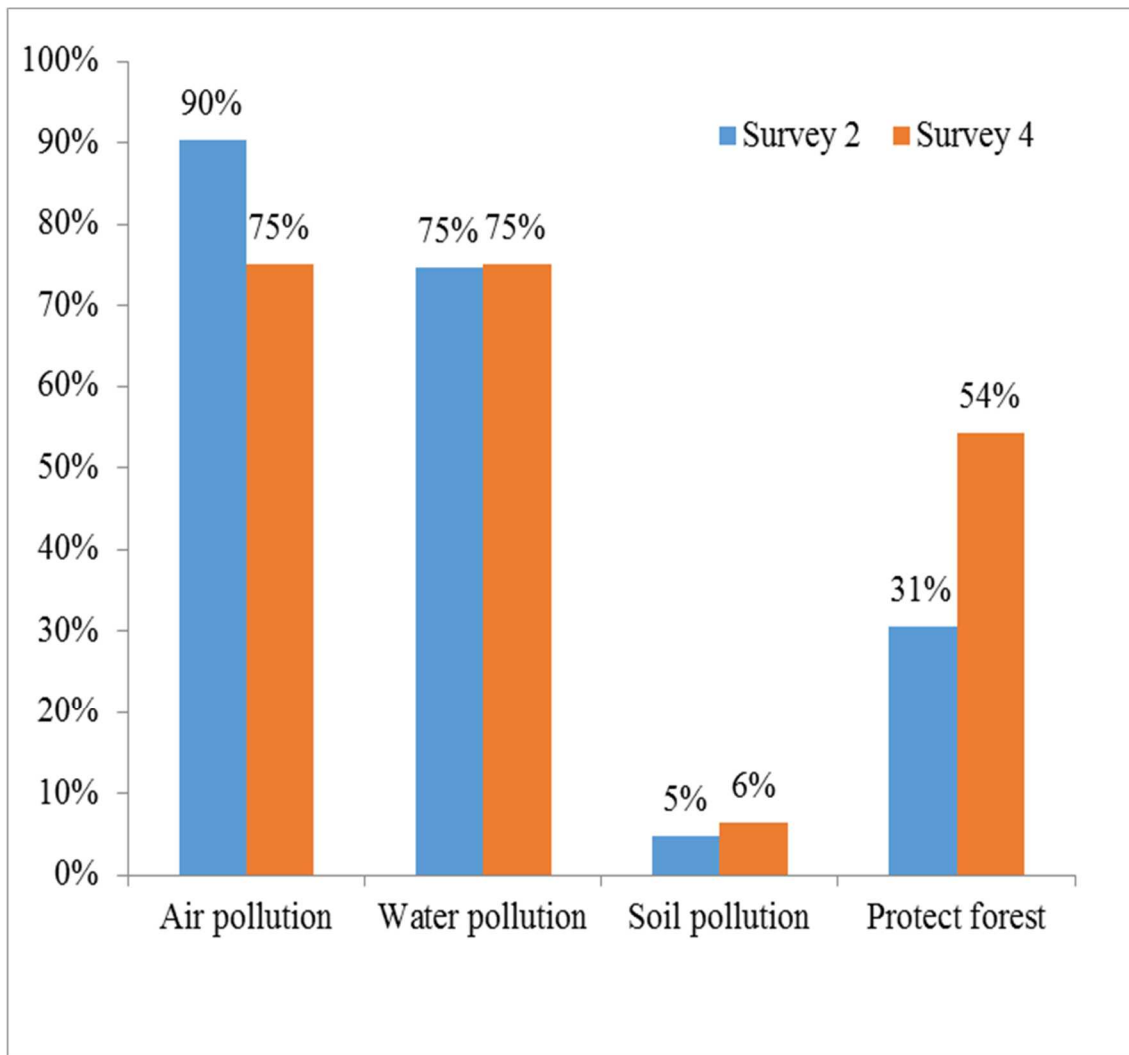


Figure 3-12 shows changes of student knowledge from environment lesson after 1 year

3.3.3 Effect of environmental activities by the author

Figure 3-13 showed the changing of student knowledge during 1 year of our survey. At survey 2, we found that student had limited knowledge about eco – bags (29%) and plastic bags (55%). After our activities at survey 3, students increased their knowledge to eco – bag (87%), plastic bag (71%), food waste (93%), and food waste systems (87%) in solid waste management. At survey 4, we found that the percentage of student knowledge decreased 2 months after the activities.

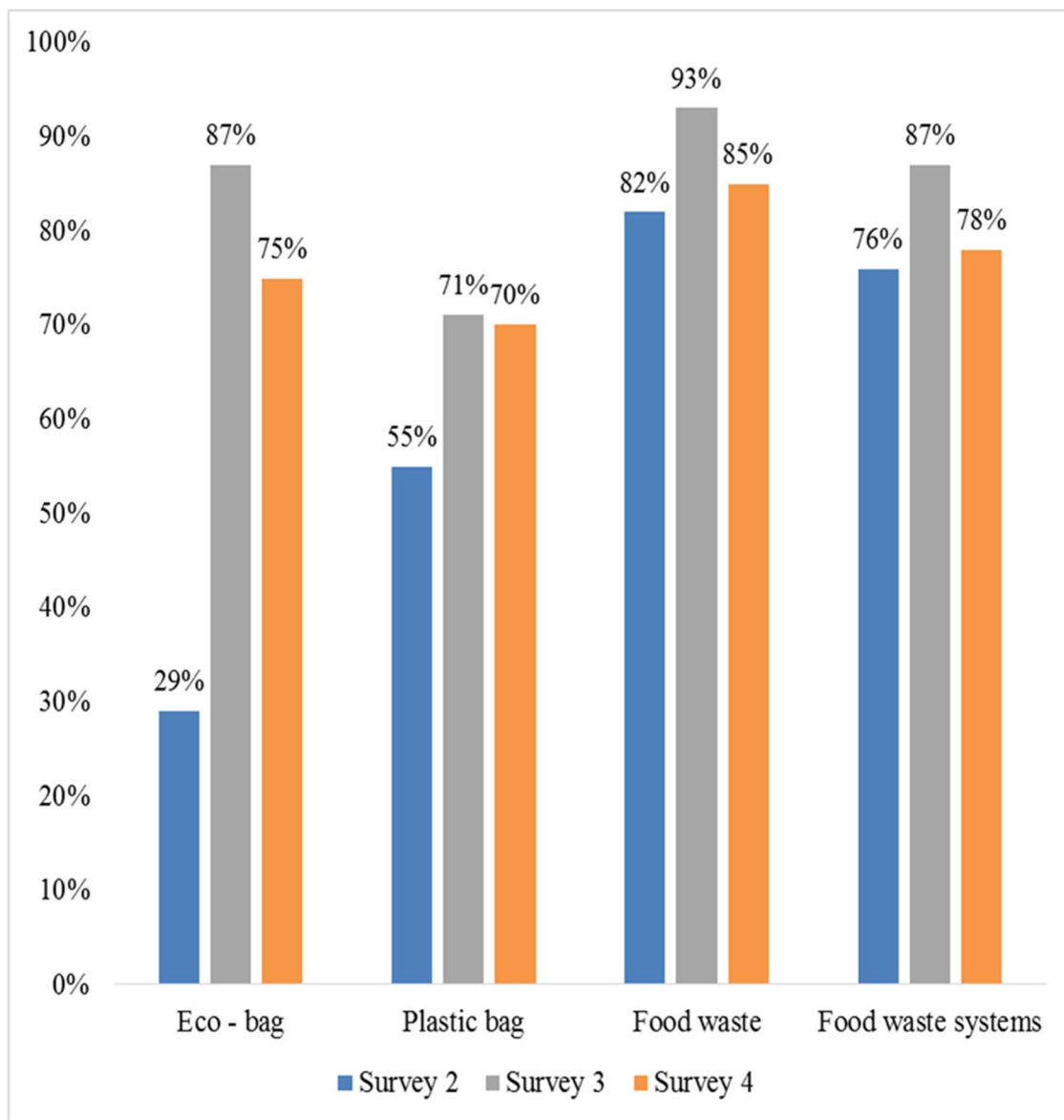


Figure 3-13 Changing of student knowledge during 1 year of our survey

Figure 3-14 showed the student knowledge about solid waste management after our environmental activities in school. Survey 3 was done 2 days after (March, 2015) our environmental activities at the elementary schools. Survey 4 was done 2 months after (May, 2015) we did environmental activities in the school. Student knowledge (organic waste: 90%, non – organic waste: 86%, recycle or reuse waste: 83%) was high after our activities. But 2 months later, their knowledge decreased to lower than in survey 3 (organic waste: 82%, non – organic waste: 70%, recycle or reuse waste: 70%).

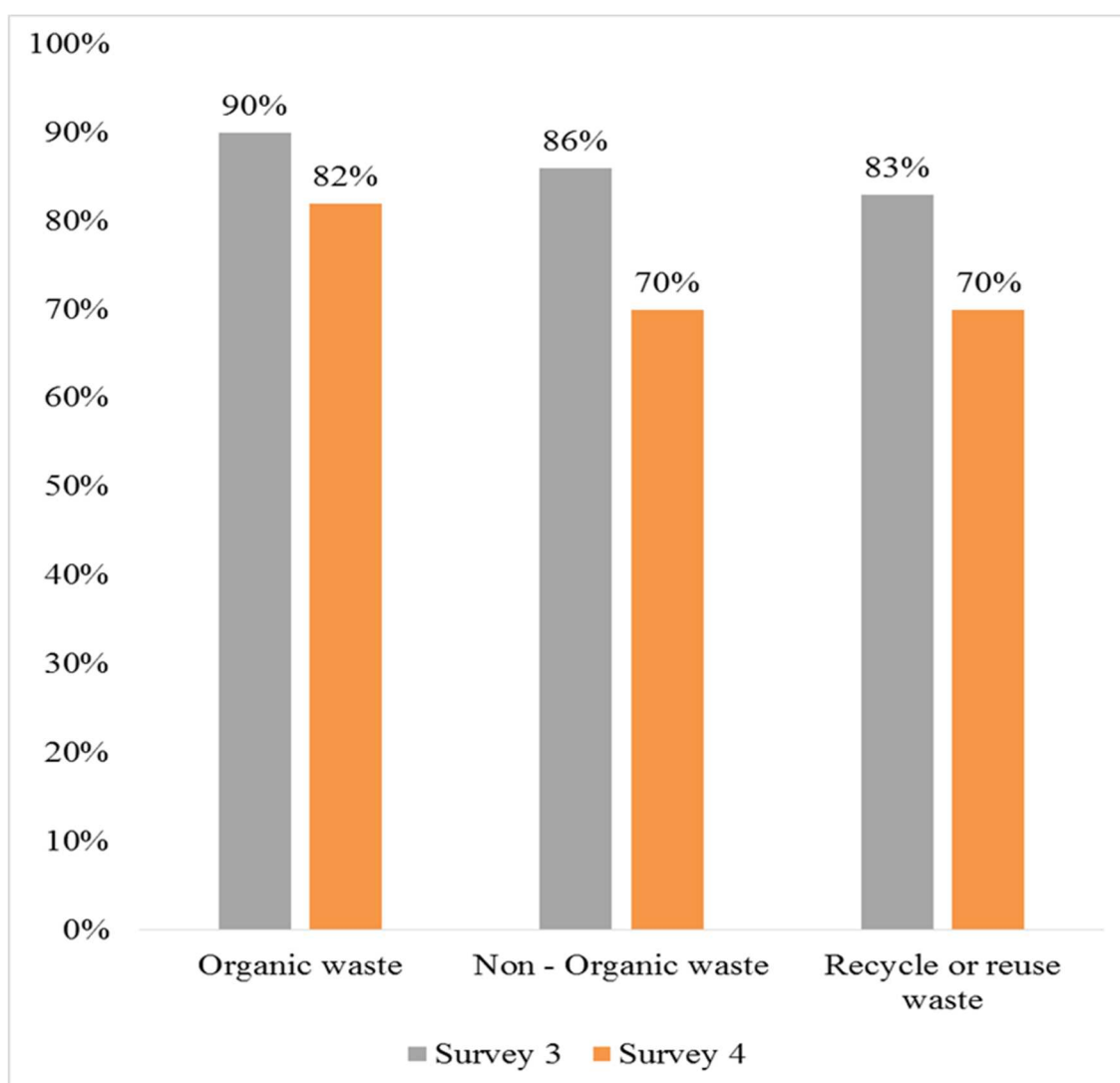


Figure 3-14 Student knowledge about solid waste management after our environmental activities in school

Figure 3-15 showed a comparison in knowledge between students who had EE from us and student who had no EE about solid waste management. We could see that students who had environmental activities from us had higher knowledge than student who didn't have environmental activities from us. We used Chi – Square tests to check the relation between the 2 groups of student. We found that all “P values for exact chi-square tests” of these 2 groups were under 0.05. The minimum expected count was small (organic waste: 22.56; non – organic waste: 32.46; recycle or reuse waste: 28.46).

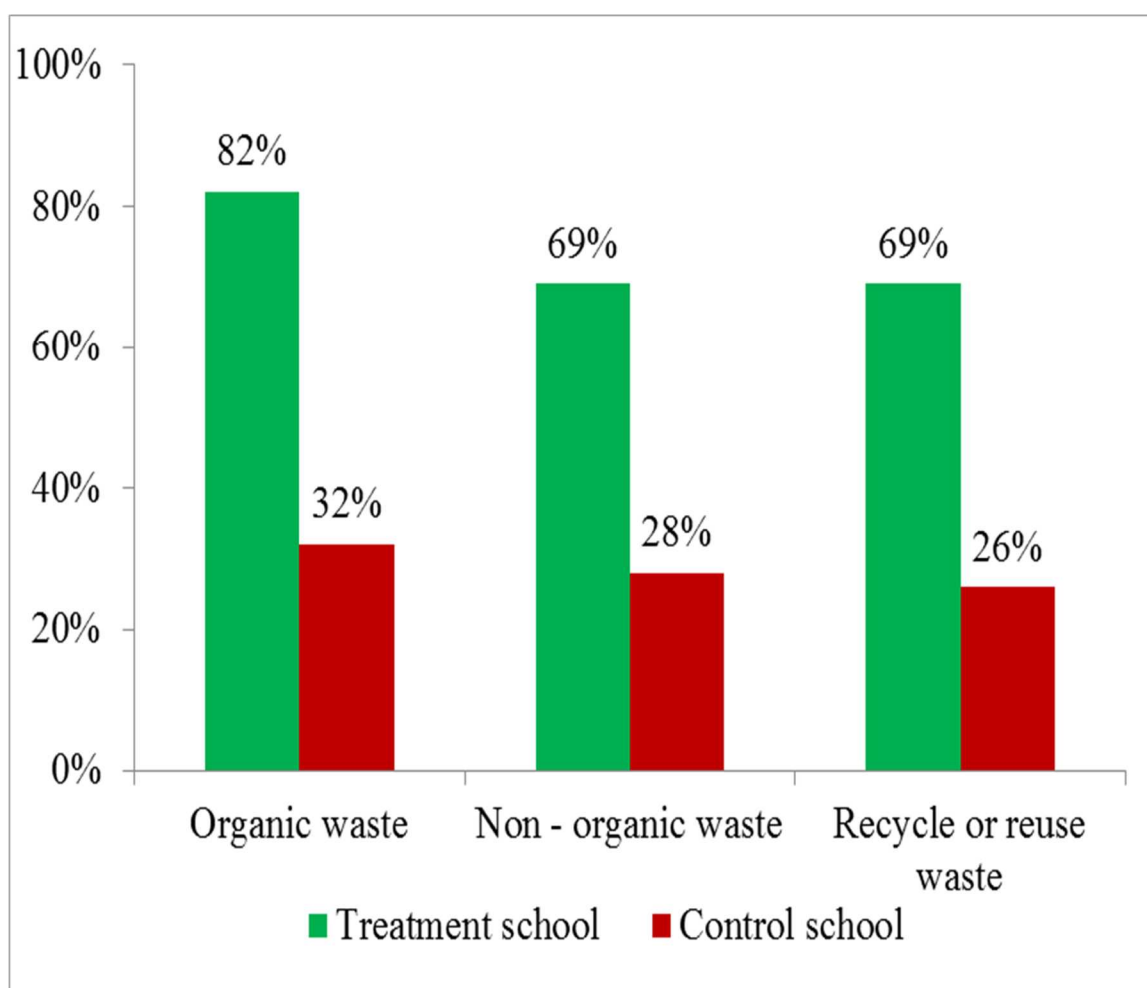


Figure 3-15 Comparison in student knowledge

Table 3-5 Comparison of results between with/out game

	Survey 3		Survey 4	
Question 2 (Organic waste)	Group with game	Group without game	Group with game	Group without game
	$X^2(1) = 0.286, P = 0.709$		$X^2(1) = 0.912, P = 0.369$	
Question 3 (Non-organic waste)	Group with game	Group without game	Group with game	Group without game
	$X^2(1) = 1.349, P = 0.270$		$X^2(1) = 0.785, P = 0.382$	
Question 4 (Recycle or reuse waste)	Group with game	Group without game	Group with game	Group without game
	$X^2(1) = 0.221, P = 0.654$		$X^2(1) = 0.014, P = 1.000$	
Question 8 (Nylon bags)	Group with game	Group without game	Group with game	Group without game
	$X^2(1) = 0.745, P = 0.402$		$X^2(1) = 0.502, P = 0.491$	

Table 3-5 showed the statistical results between the groups of students who joined EE with a game and the groups who join EE without a game. The study did not find statistical differences between the groups. The game did not affect student knowledge when they joined EE activities.

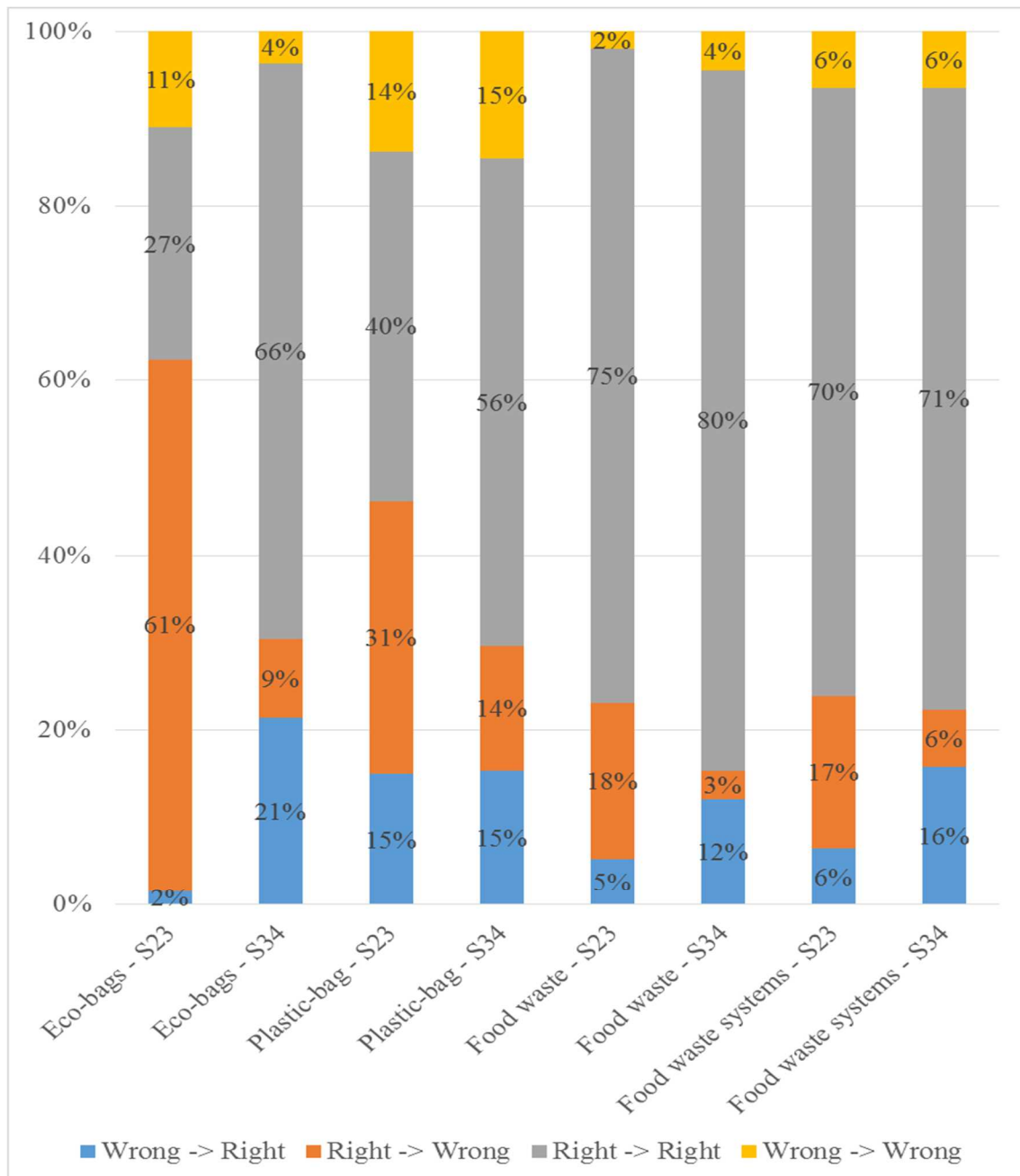


Figure 3-16 Students' answers from survey 2, 3 and 4 one-time EE

The study made a calculation of student answers between surveys 2 and survey 3, and survey 3 and survey 4 to evaluate change after one-time EE and 3 months after one-time EE lessons. We can see that before the one-time EE (survey 2) and after the EE lesson (survey 3), 61% of students changed from the wrong to right answer for the eco-bag question and 31% for the plastic-bag question. In addition, the percentage of students changing from one wrong answer to another to wrong answer reduced between survey 3 (after one-time EE) and survey 4. This was 3 months after one-time EE. The study found that the percentage of students who changed their answer from right to wrong for food waste and food waste systems was small. Just 18% of the students changed from the right to wrong answer for the food waste question. In addition, we found that the percentage of students who maintained a right answer on food waste and food waste systems were very high before and after EE lesson. It was 75% for the food waste question and 70% for food waste systems. The study observed that food waste educational contents were related to a student's daily life. The study found that 80% still kept the right answer 3 months later on the food waste question, and 71% on food waste systems.

3.3.4 Student's thinking about authors environmental activities

Figure 3-17 showed the checklist of students' thinking after environmental activities from us. We gave this checklist to student after our activities in class. We wanted to understand what students thought about our activities. We handed out the checklist to students along with the questionnaire survey.

My Feeling About Environmental Education Activities



	YES	SOMETIMES	NO
1. I like to join activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I want to attend again	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Activities are hard for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I like to do other environmental education activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I like to attend activities with my friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I like to attend activities with my family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Activities are boring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. If you have any idea about activities. Please write down in below	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
.....			
.....			
.....			
.....			
.....			

Figure 3-17 Student checklist

Figure 3-18 showed the difference between students who join EE with game activities and without game activities. The numbers 1, 2, 3, 4, 5, 6 and 7 are number of questions. Students thought about our environmental activities where 95% of the students liked to participate with, 87% wanting to attend activities again. More than 70% of the students wanted to participant with a friend and family member.

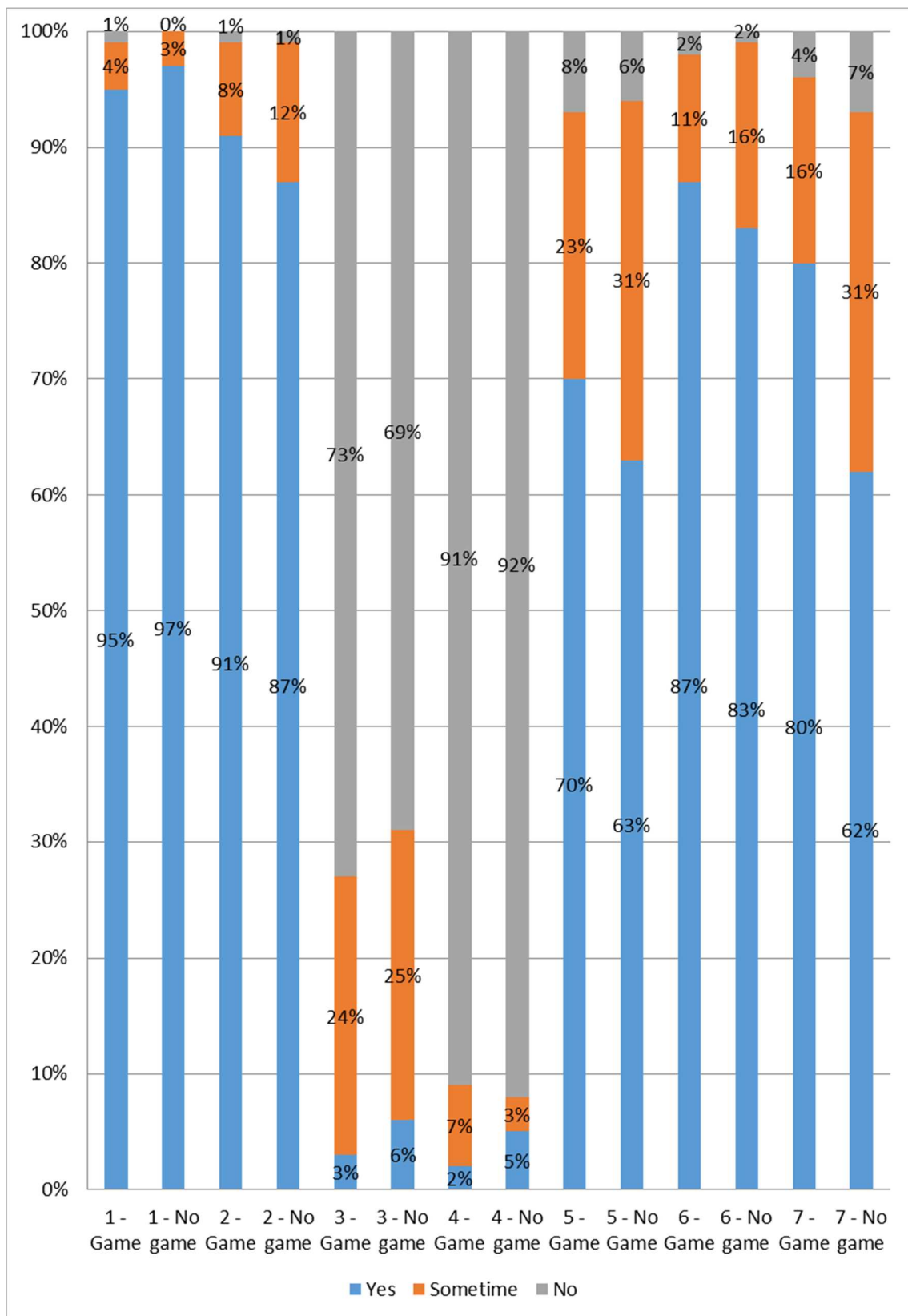


Figure 3-18 Result from student checklist

3.4 Limitation

The study reveals certain strategic constraints of the EE activities prevalent in the schools.

First, our activities were done just one-time, and the grades/marks obtained in EE activities were not counted in their term score. It was found that for this reason the activities were not taken seriously in some schools.

Second, our activities were done one-time in class. So after 2 months, student started to forget what they studied during our activities.

The study reveals certain strategic constraints of the EE done by the authors. This EE was done just once, and the grades obtained were not counted in the students' scores. For this reason, the activities might not be taken as seriously and may not actually change students' behaviour.

For our future research, we will continue to make activities for elementary students. We want to increase student's knowledge about the environment especially in the area of solid waste management. We will conduct more activities for the student in long time such as 6-month for example.

3.5 Conclusion

B.1 Development of one-time educational course:

- The study developed EE activities in 30 minutes for 5th grade student.

C.1 Develop evaluation method

- Used a treatment – control design to evaluate impact of one-time EE. The study involved a total 591 students from 1 treatment school and 2 control school that included 9 classes in grade 4 and 9 classes in grade 5.
- We did EE in 2 groups of student from which 1 group had a separation waste game and the other group had no game.

C.2 Measurement of the impacts of EE from the textbook

- The study provided a summary of environmental contents from the Vietnamese textbook. We found that elementary students in Vietnam have basic knowledge about the environment. Also, they don't know much about solid waste management.
- We used chi-square tests to examine the effect of environmental lessons in school. We found that the environmental lesson from school had a good impact on students. The students can remember EE knowledge from the school lesson even after 1 year.

C.3 Evaluation of one-time education

- The study found that students increased knowledge of solid waste after joining EE activities. But after 3 months, student's knowledge decreased on eco-bags and food waste. In schools that had EE, the students improved their knowledge of solid waste compared to school did not have EE.
- The study did not find any difference in student knowledge from the game and without game groups. However, students who joined the game activities had more intentions on EE activities than those without a game.
- The results from the checklist showed that 95% of the student liked to participate in environmental activities, with 87% wanting to attend again.

Chapter 4 OBSERVED ENVIRONMENTAL EDUCATION IN JAPAN AND DEVELOP ENVIRONMENTAL EDUCATION IN VIETNAM

4.1 Introduction

B.2 Develop 6-month workshop course: The main purpose of this chapter is to create and develop a 6-month workshop course on solid waste management education adopting and adapting the Japanese experience of EE. The tasks were to:

- Observe EE lesson for 4th grade student in Japanese elementary school.
- Make a summary of Japanese EE.
- Create questionnaire for Japanese elementary student to understand the objective of EE at Japan.
- Compare situation education between Japan and Vietnam.
- Adopted and adapted the Japanese experiment to create a 6-month EE for elementary school students in Vietnam.

4.2 Methodology

I conducted a literature review to understand the differences between education in Japan and Vietnam. Some general findings are that the definition of the environmental problem is culture bound (McGlen, Mibrath, & Yoshii, 1979).

Together with the literature review, I registered with the Kitakyushu City Board of Education (北九州市教育委員会) to join EE classes in elementary schools in Kitakyushu city, Japan. I wrote an email to the Guidance Manager at Kitakyushu City Board of Education to get permission to enter the EE lessons at elementary schools in Japan. I made a presentation to introduce my research with the objectives and stated why I wanted to join EE lessons in Japan. I need to wait for a week to get permission from elementary schools. “あやめが丘小学校” accepted me to visit their school and join EE lessons. I visited Ayamegaoko elementary school in April 2016, 2 months before EE lesson started at school.

To better understand EE in Japan, I conducted a questionnaire survey in 2 classes and studied EE with them. I participated in the class like any other student would. At the end, I gave a presentation introducing the countries I am studying and myself to the students.

4.3 Background of environmental education in two countries

4.3.1 Characteristics of elementary education

Environmental problems are different from country to country, and not same type of problems exists. It depends on society, culture and natural surroundings. Therefore, it may require a different type of solution including education and technology. To apply the education solution from Japan to Vietnam the study wanted to understand the differences in characteristics of elementary education between Japan and Vietnam (Table 4-1).

Table 4-1 Characteristics of elementary education in Japan and Vietnam

	Japan	Vietnam
School year segmentation	Total: 12 years - Elementary 6 years - Junior high school 3 years - High school 3 years	Total: 12 years - Elementary 5 years - Junior high school 4 years - High school 3 years
Enrollment ratio	The Japanese primary school enrolment rate exceeds 99% (Yamasaki, 2016).	Vietnam achieved universal primary education in 2000. Between 2001 and 2010, the net enrolment rates increased significantly. Enrolment in primary education increased from 94 to 97 per cent. (TheWorldEducationForum, 2015). (Spacing)
Student teacher ratio	Class size and school size tend to be smaller in rural areas. By law, the maximum class size for public elementary is set at 40, and at 35 for the first and second grades in elementary school. Most elementary schools have a class size of 26 to 30. The number of regular teachers in each public compulsory school is determined by the number of classes in the school, according to the public school standard law (Yamasaki, 2016).	By law, the maximum class size for public elementary is set at 35. Most have a class size of 40-50 wherein some elementary school has a class size of 60 in big cities, such as Ha Noi or Ho Chi Minh (According to Article 17 of the Charter of the Vietnamese elementary school).
Textbook policy	- No single national textbook. However, textbook need to get national certification from the Japanese Ministry of Education. - Local textbook (belong to local government).	National textbook.

4.3.2 National environmental education policy

EE emerges as one of the possible strategies to face up to the double-order, cultural and social, civilization crisis. The government must play the role of

strengthening civil society as the mainstay of superstructure (Sorrentino, Trajber, Mendonça, & Ferraro Jr, 2005). The study wants to show national policies and objectives for EE in Japan and Vietnam (Table 4-2).

Table 4-2 Environmental education objectives in Japan and Vietnam

Japan	Vietnam
<p>Education in the environment is to foster interest in the environmental and rich receptivity toward nature through various experiences in natural and in local communities.</p> <p><u>Objectives:</u></p> <ol style="list-style-type: none"> 1. Foster receptivity towards nature: Enable students to be interested in all events and phenomena in their surrounding environments, to be highly motivated to interact with such environments and to be highly receptive towards nature. 2. Foster environmental perspectives and thinking: Foster views and ways of thinking about the environment that will lead to building a sustainable society by providing children with the ability to seek out and solve problems from events and phenomena in their immediate environmental and social surroundings. 3. Foster ability to take action concerning the environment: Enable students to think and act upon choices about lifestyles that conserve the environment and about what practical steps to take, to take responsible action on their own, and cooperate in problem-solving. <p>Additionally, cultivate not only efforts for change in daily lifestyles but also the ability to take action to build a brighter environment in the future towards creating a sustainable society.</p> <p>(Curriculum Research Center of Japan, 2007)</p>	<p>The Prime Minister's Decision No. 153/2004/QD-TTg, publicizing the strategic orientation for sustainable development in Vietnam which implements Agenda 21 in Vietnam (the main features of which include sustainable development components). Sustainable development is the harmonious development in terms of Economic - Social - Environmental aspects to meet the needs of present generations without compromising, hindering the ability to provide resources for economic development, quality of life of the future generations (Hoang, Do, & Perera, 2009).</p> <p><u>Objectives:</u></p> <ol style="list-style-type: none"> 1. EE as ESD through educating of water resource and planting value. 2. Life skills education as ESD: For pre-school education, life skills education in primary level, life skills education in lower secondary level, life skills education for upper secondary students. 3. Cleaner Production.

4.3.3 Difference between school in Kitakyushu city and Da Nang city

Table 4-3 Difference in characteristics of elementary school in Kitakyushu and Da Nang city

	Kitakyushu city	Da Nang city
Student teacher ratio	Less than 25 Students per class	More than 40 students per class
Lesson time	45 minutes	30 minutes
Textbook	Kitakyushu textbook (Shakai book)	Vietnamese national textbook
Solid waste management	Separation and treatment systems components.	<ul style="list-style-type: none">- All garbage discharge to landfill.- Informal recycling of food waste, can, bottle and paper to sell to scavengers.

4.3.4 Environmental policy in Kitakyushu and Da Nang

In addition, local government can use difference ways to apply national policy. To understand the situation between 2 cities Kitakyushu and Da Nang, the study summarized city policy from both Kitakyushu and Da Nang (shown in Table 4-4).

Table 4-4 city policy from Kitakyushu and Da Nang

Kitakyushu	Da Nang
<p>The City of Kitakyushu in Fukuoka Prefecture is the 13th largest city in Japan. Located on Kyushu island just south of the Japanese main island and is regarded as a gateway to Asian economies.</p> <p>In 1971, prior to the establishment of the Environmental Agency by the national government, Kitakyushu founded the Environmental Pollution Control Bureau (currently the Environment Bureau). Kitakyushu City also established a number of regulations, including the Kitakyushu Pollution Control Ordinance which was more stringent than the national laws at that time and enforced a series of effective measures that targeted major companies in the city, including the execution of agreement to prevent pollution. Responding to the local government request, private enterprises introduced cleaner production, including energy conservation, resource, recycling, and pollution reduction through technological innovation and capital investment. These collaborative efforts between citizens, businesses, and local government helped to bring significant improvement to Kitakyushu's environment (Ministry of Foreign Affairs of Japan, 2015).</p> <p>The Organization for Economic Co-operation and Development (OECD) of 1985 introduced Kitakyushu's improved environment to the world as the example of city transformed from a 'Gray city' to a 'Green city'.</p>	<p>The City People's Committee Decision on the "Promulgation of the Plan for Developing Da Nang—The Environmental City" lays the foundation for city planning in the context of sustainability and encourages resource efficiency (TheWorldBank, 2013). The year 2020 was set as a target for many different environmental issues such as air pollution reduction, waste treatment and recycling, energy conservation, and renewable energy. The plan is based on Agenda 21 of the Vietnamese government (Prime Minister's Decision No. 153/2004) and Vietnamese Environmental Standards 2. The general goals for the Environmental City Plan are to: (1) Provide a safe and healthy environment for people, assuring land, water, and air quality; (2) Prevent environmental pollution and degradation; and (3) Make the people of Da Nang city aware of environmental protection and Da Nang's development as an environmental city (Phan Hoang & Kato, 2016).</p>

4.3.5 Source separation practice in Kitakyushu and Da Nang

According to the Waste Management and Public Cleansing Law (1970), solid waste is divided into two broad categories of municipal waste and industrial waste in Japan (Ministry of Foreign Affairs of Japan, 2015).

Kitakyushu



Figure 4-1 Municipal solid waste management systems in Kitakyushu City

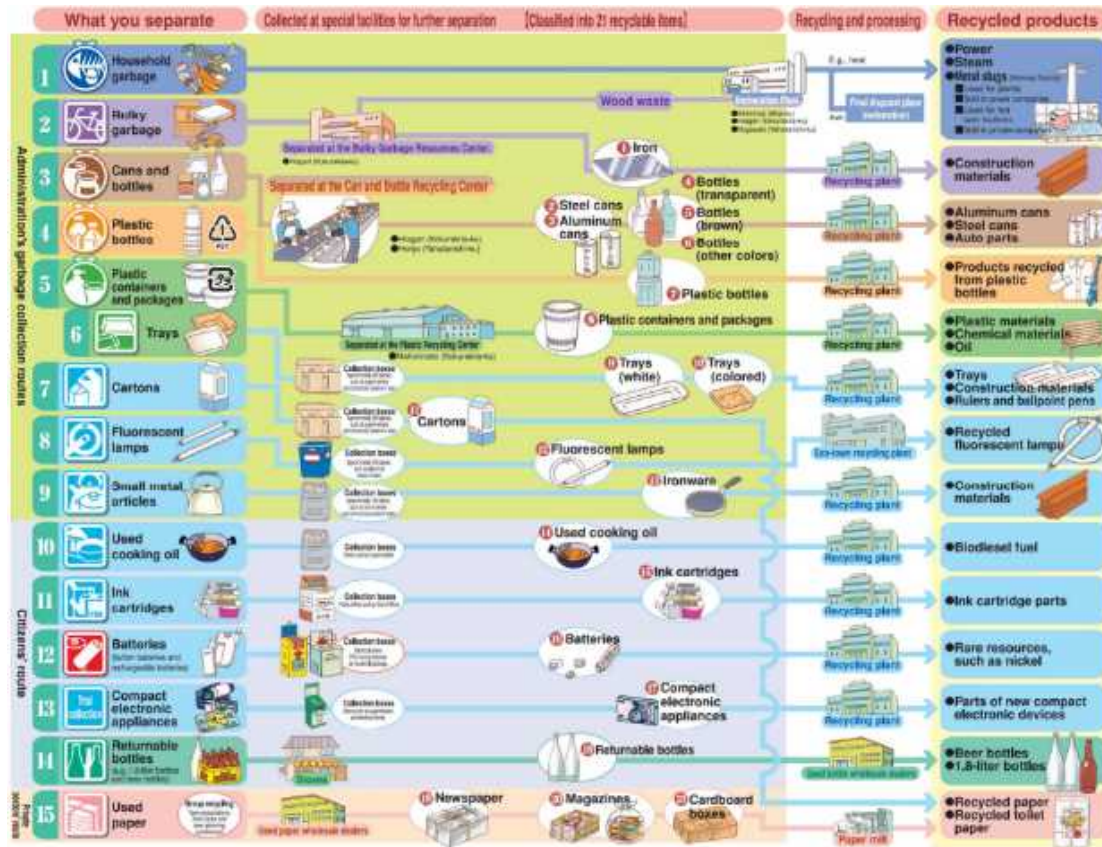
*Source: Background Paper on the City of Kitakyushu, OECD Green Cities Programmer (Final), City of Kitakyushu, 2012.

The City of Kitakyushu applies the separated waste collection system where each household separates waste into 15 types or 21 categories and dispose of them accordingly (Ministry of Foreign Affairs of Japan, 2015).

Residents are requested to purchase the designated bags to put their household or kitchen waste and others separately. The household waste is collected twice a week while other recyclable items are collected once a week. The city has established waste collection stations at a ratio of one location for 10-20 households to ensure efficient operation. Residents bring their waste to collection points by 8:30AM of the specified collection day. Each collection point has a blue coloured net to cover the waste to prevent from animals from accessing the waste. The residents have the responsibility to clean, manage and monitor the collection points. (Ministry of Foreign Affairs of Japan, 2015).

“The city also placed special collection boxes at different locations including selected supermarkets, community centres, and convenience stores to collect some recyclable materials such as cartons and trays, electric appliances,

and other materials”. The city provides approximately seven JPY per kg for the recovering group, to motivate voluntary groups in recycling activities (Ministry of Foreign Affairs of Japan, 2015).



*Source: Solid waste management system of the City of Kitakyushu, Kitakyushu City, 3rd Asian Sanitation Dialogue, 28 May 2014, <http://wastewaterinfo.asia/sites/default/files/downloads/S5-03-Ikeda.pdf>, Accessed on 23 September 2018.

Figure 4-2 Waste Separation Types in Kitakyushu City

Based on the past experience in improving the environmental problems, Kitakyushu City promotes the environmental actions with residents as an environmental learning system in the city.

- These activities focus on creating an interest in resource and waste management based on the 3Rs principle.

- The city implements awareness promoting activities through various environmental events such as Eco Life Stage.
- My Bag Campaign was established to reduce the consumption of shopping bags, encouraging residents to use their own bags.
- A variety of measures are introduced to educate young and school kids on EE and 3R activities.
- The city established the Environmental Museum in 2001 as a historical place for environmental issues and learning.
- A set of comprehensive and systematic EE textbooks (Midori Note) was published in collaboration with the Education Council targeting different age groups, from infants to junior high schools (Ministry of Foreign Affairs of Japan, 2015).

Da Nang

According to the Da Nang Urban Environment Company Limited (Da Nang URENCO), SMW in the city and the quantity of solid waste in the city is increasing. In most urban areas, municipal solid waste (MSW) is not officially sorted at source. Few households separate their solid waste by selling bottles, jars, metal, and paper to scrap collectors. However, in recent years, a number of pilot projects promoting solid waste separation have been implemented in the large cities Hanoi, Da Nang, and Ho Chi Minh. For several reasons, these efforts have not been very successful, partly due to the lack of community awareness; collection and problems with final treatment.

Da Nang City promotes the environmental activities:

- The 3Rs (reduce, reuse, and recycle) approach focusing on community participation (Dao, Downs, & Delauer, 2013).

- EE for sustainable development at elementary schools in Da Nang city (Phan Hoang & Kato, 2016).

4.4 Observed elementary environmental education example in Kitakyushu

4.4.1 Goals of this environmental education

- 1) Understanding the fact that projects and policies related to disposal of waste is helping people in the neighbourhood improve and maintain their living conditions.

As a member of local community, develop interests in disposal of waste and participate in activities to reduce wastes and recycle resources.

- 2) By observing, researching and reading documents about disposal of waste, which is necessary for people in the area, understanding that projects and policies must be managed by planning and participation as well, will help to improve living conditions for the people in the area.

4.4.2 Evaluation criteria

Table 4-5 summarizes evaluation criteria of students that were prepared by the teachers of this EE course.

Table 4-5 Evaluation criteria of students

<p><i>Interests, willingness and attitude toward social events</i></p> <ul style="list-style-type: none"> • Having interest in activities related to disposal of waste, which is necessary for people in the area, and research is done with enthusiasm. • Participation in activities to reduce wastes and recycle resources are done by members of the local community.
<p><i>Social consideration, determination and expressions</i></p> <ul style="list-style-type: none"> • Policies and projects related to disposal of waste are expressed according to considerations of learning issues and plans. • Understand that politics and projects related to disposal of waste are helping people in the area improve and maintain a good environment by connecting our everyday lives and they express this in an appropriate manner.???
<p><i>Skills of observation and research</i></p> <ul style="list-style-type: none"> • Activities related to disposal of waste which is necessary for people in the area. <p>A summary was made by collecting the necessary information through one-site observation, research, and collection of concrete documents.</p>
<p><i>Understanding and knowledge of social events</i></p> <ul style="list-style-type: none"> • Understanding that policies and projects related to disposal of waste help people in the area maintain good living conditions.

4.4.3 Course outline

Total time: 13 hours (including 3 hours 45 minutes lesson in classroom and 9 hours 15 minutes out-door activities)

Class hour: 14:15 ~ 15:00 (5th period)

Number of lessons: 5

Number of students per class: 23

4.4.4 Contents of each lesson

- Lesson 1: Observe waste truck when it collects waste at school

Date: 8 June, 2016

Objectives:

Students were educated on the importance of waste collection using the truck as a tool for education.

Content:

Students answered the questionnaire survey from the author.

- Lesson 2: Let's examine garbage disposal efforts in Kitakyushu city

Date: 13 June, 2016

Objectives:

Shops, local government and citizen cooperate to reduce waste in the city.

Content:

- 14:15 ~ 14:25: Teacher goes over last lesson's contents.
 - 14:25 ~ 14:36: 10 minutes for students to answer questions from teacher
 - 14:36: Teacher show supermarket pictures
 - 14:40 ~ 14:45: Students answer questions in their notebooks
 - 14:50 ~ 15:00: Questions and comments from students
- Lesson 3: Let's reduce the waste and think about what we can do

Date: 15 June, 2016

Objectives:

To protect the environment, we will try our best to reduce waste.

Content:

- 14:15 ~ 14:20: Teacher go over last lesson's contents.
- 14:20 ~ 14:25: Teacher asks questions about recycling waste
- 14:25 ~ 14:35: 10 minutes for students to answer questions from teacher

- 14:35 ~ 14:40: Teacher shows students how much waste/day/person can be discharge to the environment in Kitakyushu
- 14:40 ~ 14:50: Students work
- 14:50 ~ 15:00: Students answer question: how to reduce, reuse and recycle waste in their notebooks.

- Lesson 4: Please summarize what you studied in the newspaper

Date: 20 June 2016

Objectives:

Student should promote how to reduce the waste.

Content:

- 14:15 ~ 14:35: Teacher ask student: what can each student do to reduce waste
- 14:35 ~ 15:00: Students make their newspapers
- Lesson 5: Please summarize what you studied in the newspaper

Date: 23 June, 2016

Objectives:

Students should promote how to reduce waste.

Content:

- 14:15 ~ 14:25: Teacher go over last lesson's contents
- 14:35 ~ 15:00: Students make their newspapers
- 15:00 ~ 15:15: Students answer the questionnaire survey

4.4.5 Observation survey of students

We observed 4th and 5th grade students cleaning up at school in the morning before lessons.

In addition, we observed students serve themselves food and clean up after eating at lunchtime.

4.4.6 Questionnaire survey

We provided 2 questionnaire surveys to evaluate student knowledge and behavior before and after lessons at school. The study gave students 18 questions at survey 1 (before waste separation in the classroom) and survey 2 (after waste separation) to measure the impact of lessons from the teacher on student knowledge and behavior. We used 5 questions (question 1, 15, 16, 17 and 18) out of 18 to evaluate difference between Japanese student and Vietnamese student before and after EE. The teacher administered the questionnaire to students in the classroom, where students had 10 minutes to answer the questions. We required that the teacher not help students when they answered the questions.

かんきょうについてのアンケート

あなたがかんきょうについて知っていることや、考えていることについて質問します。あてはまる答えに○をつけてください。

番号	質 問	はい	いいえ	わかりません
1	あなたは今まで、学校の外で、家から出るごみについて勉強したことがありますか？			
2	ごみを分けることについて知っていますか？			
3	1週間のうち、ごみを集める日がいつか、知っていますか？			
4	北九州市のエコタウンでごみをリサイクルしていることを知っていますか？			
5	ごみをもやして電気を作っていること知っていますか？			
6	木や食べ物のごみからひりょうを作れることを知っていますか？			
7	家でごみからひりょうを作っていますか？			
8	テレビの捨てかたについて知っていますか？			
9	かんきょうの問題について、よく知りたいと思いますか？			
10	あなたは、なにか、ごみをへらすことをしていますか？			
11	家のごみを分けるのを手伝っていますか？			
12	家の人のごみを捨てるのを手伝っていますか？			
13	学校に通う時、ごみが落ちていますか？			
14	きちんとごみをかたづけないと、かんきょうにわるいと思いますか？			
15	家のごみを捨てるのは、お父さんとお母さんのしごとだと思いますか？			
16	家のごみを捨てるのは市役所 <small>しやくしょ</small> のしごとだと思いますか？			
17	あなたも家をきれいにするためにがんばろうと思いますか？			
18	あなたも家のごみをへらすためにがんばろうと思いますか？			

さいごに、あなたの性別に○をつけて下さい：【 男 女 】

Figure 4-3 Questionnaire survey

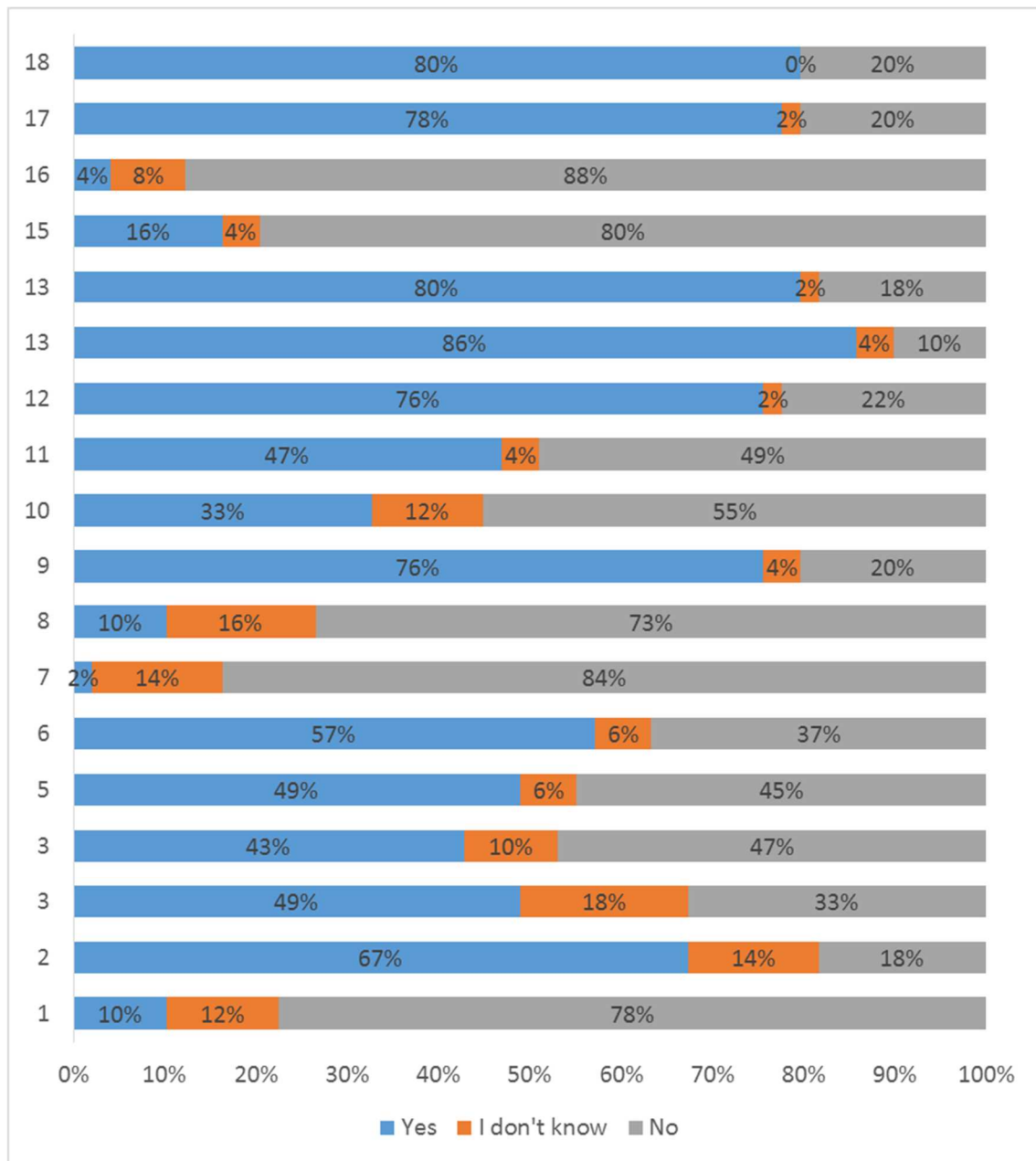


Figure 4-4 Student knowledge before the environmental education lesson from the teacher

The study found that Japanese students have basic knowledge about solid waste management, especially the field of separating wastes. At survey 1, 67% of the students answered that they knew about separation wastes, 49% knew about the collection time. In addition, Japanese students had an awareness of their individual environmental activities, 80% students answered that separation waste was not their parents or community's responsibility at survey 1.

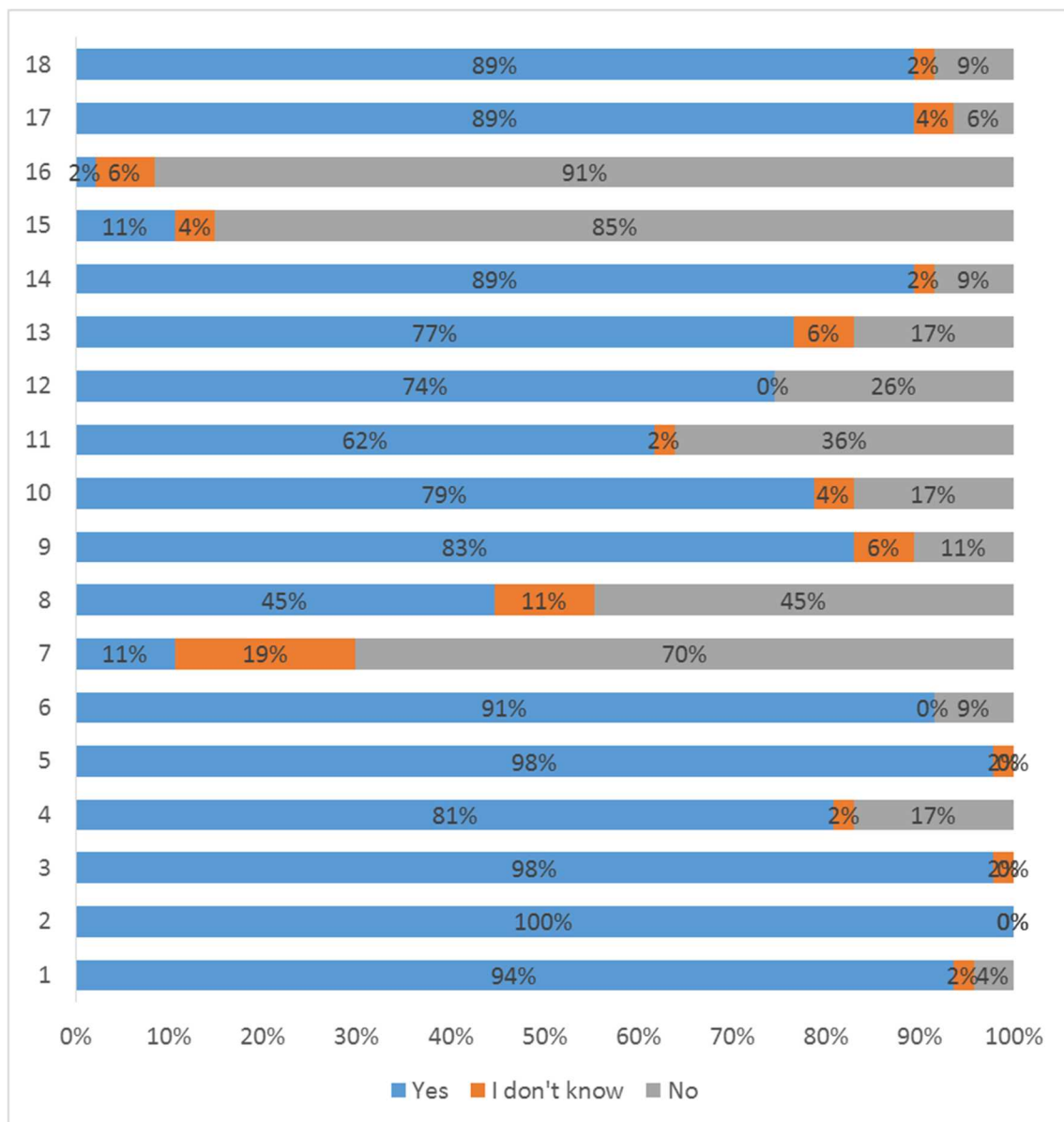


Figure 4-5 Student knowledge after environmental education lessons from the teacher

Figure 4-5 showed that after EE lesson at the school, 100% of the students said that they knew about waste separation at home, compared to 67% at survey 1. 45% said that they knew how to discard electronic waste, especially the television.

4.5 Development of an environmental education program for Da Nang city

4.5.1 Goals of this environmental education

Understanding the situation of solid waste management in Da Nang city. Separating waste is helping people in the neighbourhood to improve and maintain their living conditions.

4.5.2 Course outline

Table 4-6 Course outline of Da Nang application

	Class 4.1	Class 4.2
Student number	37	40
Date	Tuesday, every 2 weeks	Tuesday, every 2 weeks
Period	1	3
Number of lessons	10	10
Time	14:00 ~ 14:30	15:50 ~ 16:20
Duration	6 months From October, 2016 until March, 2017	6 months From October, 2016 until March, 2017

Contents of each lesson

- Lesson 1: Introduction

Objective:

- 1) Giving students basic information about solid waste management will be taught over the next 9 lessons.
- 2) Students will complete a questionnaire to evaluate their knowledge before the lesson.

Content:

- 14:00 ~ 14:05: Introduced lesson contents and myself
- 14:05 ~ 14:10: Made student groups
- 14:10 ~ 14:30: Questionnaire survey

- Lesson 2: Solid waste management situation in Da Nang city

Objective:

- 1) Understand students' knowledge about the situation of solid waste in Da Nang city.
- 2) Introduce the situation of solid waste management in Da Nang city to students.

Content:

- 14:00 ~ 14:05: Played small game to understand student knowledge
- 14:05 ~ 14:18: Give students basic knowledge about solid waste management in Da Nang city
- 14:18 ~ 14:20: Give student waste bags to understand how much waste each person discharges per day to the environment.
- 14:20 ~ 14:30: Questions and comments from student

- Lesson 3: 3Rs (Reduce, reuse, and recycle)

Objective:

- 1) Introduce 3Rs concepts to students.

Content:

- 14:00 ~ 14:05: Review last lesson's contents with students
- 14:05 ~ 14:15: Questions time

Question 1: How can we reduce waste?

Question 2: What is 3Rs?

- 14:15 ~ 14:25: Teach student 3Rs concepts

- 14:25 ~ 14:30: Questions and comments from student

- Lesson 4: Recycle produce

Objective:

- 1) Introduce recycled products to student.
- 2) Teach students how to make toys from waste.

Content:

- 14:00 ~ 14:05: Review last lesson's contents with students
- 14:05 ~ 14:15: Introduce student to recycled products
- 14:15 ~ 14:30: Made recycled products with student
- Lesson 5: Food waste situation in Da Nang city

Objective:

- 1) Introduce food waste systems in Da Nang city.
- 2) Introduce food waste systems in general.

Content:

- 14:00 ~ 14:10: Questions to go over the last lesson's contents with students

Table 4-7 Questions to go over material learned in the last lesson

Question 1: Please circle your answer, what kind of waste can we recycle? a) Pet bottle b) Can c) Newspaper d) Bin
Question 2: What we can do with food waste at home?
Question 3: What do you think of using food waste to feed pigs? Why?

- 14:10 ~ 14:20: Introduce food waste systems in Da Nang city in general to students

- 14:20 ~ 14:30: Questions and comments from student

- Lesson 6: Waste separation game

Objective:

- 1) Give students the opportunity to practice waste separation.
- 2) Go over material taught during the last 5 lessons.

Content:

- 14:00 ~ 14:05: Go over last lesson's contents
 - 14:05 ~ 14:20: Play wastes separation game
 - 14:20 ~ 14:30: Introduce next lesson, and receive questions and comments from student
- Lesson 7: Newspaper game

Objective:

- 1) Understand student thinking about environment
- 2) Remind students about information that they studied

Content:

- 14:00 ~ 14:10: Provide newspaper stuff and contents of newspaper
 - 14:10 ~ 14:30: Students start to write and draw their newspaper
- Lesson 8: Newspaper game and newspaper presentation activity

Content:

- 14:00 ~ 14:10: Students complete their newspaper

- 14:10 ~ 14:30: Students start to present their newspaper contents. Each group has 6 minutes (4 minutes to explain contents, 2 minutes for questions and answers)

- Lesson 9: Newspaper presentation activity

Objective:

- 1) Understand students' ideas about their newspaper.

Content:

- 14:00 ~ 14:25: Student starts to present their newspaper contents. Each group has 6 minutes (4 minutes to explain contents, 2 minutes for questions and answers)
- 14:25 ~ 14:30: Close activity

- Lesson 10: Final lesson

Objective:

- 1) Give students comments about their newspaper.
- 2) Remind student what they studied during EE.
- 3) Give students prizes for their activities.

Content:

- 14:00 ~ 14:15: Comments about newspaper activities
- 14:15 ~ 14:20: Award for group and student that had a good score for all activities. We provide a notebook with a cover that contains EE material that students studied during 9 lessons.
- 14:20 ~ 14:30: Close activities, and questions and comments from student

4.6 Discussion

Table 4-8 Difference between this study and Kitakyushu model

	Kitakyushu elementary lesson	This study
Length of EE (Solid waste management)	13 hours (included 3 hours 45 minutes lesson in classroom and 9 hours 15 minutes outdoor activities)	5 hours (in classroom)
Lesson number	5 Lessons	10 lesson
Time	1 month	6 months
Book	<ul style="list-style-type: none"> - Japanese Shakai book - Kitakyushu Shakai book 	<ul style="list-style-type: none"> - Poster from author
Activities content	Separation waste	
	<ul style="list-style-type: none"> - Groups work (4 students/ group) - Time: 45 minutes - Material: Garbage bags (1 group/ bag) 	<ul style="list-style-type: none"> - Group work (4 students/ group) - Time: 30 minutes - Material: Garbage bags (1 group/ bag) - Separation sheet
	Making newspaper	
	<ul style="list-style-type: none"> - Individual work - Time: 90 minutes (2 lessons) - Material: A3 paper (1 paper/ student) 	<ul style="list-style-type: none"> - Groups work (4 students/ group) - Time: 60 minutes (2 lessons) - Material: A1 paper (1 paper/ group) Waste pictures Colored pens
	Outdoor activities	
	<ul style="list-style-type: none"> - Visit a waste incinerator - Visit Kitakyushu eco-town 	<ul style="list-style-type: none"> - None
Evaluation systems	<ul style="list-style-type: none"> - Evaluation of system from school - Questionnaire survey from the author 	<ul style="list-style-type: none"> - Stamp systems - Questionnaire systems

Because of differences between Japanese and Vietnamese systems for elementary school, the EE activities designed with cultural differences taken into account, increased Vietnamese students EE knowledge:

- Made group work for student. Because class size in Vietnam is larger than in Japan, it may be difficult to evaluate student's individual work.
- Create many games for student to practice separation of waste because in Vietnam, we don't have separation systems like Japan. So our study gave students the opportunity to practice.
- Newspaper presentation lesson, to understand student attitude and thinking, after making the newspaper, the study contained a lesson for students to explain their ideas in their newspaper.
- This education activity provided a notebook with a cover containing EE contents that students studied during the first 9 lessons. We wanted to remind them about the environment education lesson for a long time.

Vietnam could launch a fresh start by taking lessons from Japan and study the way Japanese EE uses the application of pollution prevention measures and waste disposal system. If Vietnam designs its system from the experiences of the Japanese EE, a favourable situation will emerge in the long run which will help it avoid problems which Japan faced at its early stage of development.

4.7 Conclusion

B.2 Develop the 6-month workshop course

- In June 2016 we had a chance to attend EE lesson at “あやめが丘小学校”, Kitakyushu, Japan
- The researcher observed EE and school activities to understand the education situation in Japan. Enrolment ratio in Japanese elementary is under 25 students; the teacher can easily manage the lesson and class. In addition,

Japanese elementary students have the whole day study at school; they need to serve lunch by themselves. Elementary students can work independently.

- A survey was conducted before and after EE at a Japanese school. The EE gave students a more in depth look at solid waste management and 100% student said that knew about separation of waste at home, compared to 67% from survey 1.
- Using the data collected on EE lessons in Japan, a literature review of EE and pre-environmental education on chapter 3, the study developed 6-month EE activities for elementary student in Vietnam. The contents and evaluation of the 6-month EE will be presented in chapter 5

Chapter 5 6-MONTH ENVIRONMENTAL EDUCATION

5.1 Introduction

B.2 Develop the 6-month workshop course. This chapter's aim is to develop a 6-month workshop for elementary schools, in Da Nang.

- The EE done by the author was not an official class from the school and was done to generate interest from students. Using EE created and developed in chapter 4, the study started to select elementary schools in Da Nang city for EE field.
- The study used a workshop method to implement EE in the treatment school.

C.1 Develop an evaluation method

- The treatment-control design was used when applying the 6-month activities at elementary school in Da Nang city. An elementary school located in the same district and having same background was chosen to apply EE lessons. We chose 1 school as the treatment school where we did EE activities over 6 months. The other school was the control where we did not provide any EE activities. The study provided and collected a questionnaire survey at the same time in the 2 schools.
- The study reviewed many papers for newspaper analysis and drawing analysis.
- In addition, the study developed a model analysis for student intention based upon the theory of planned behaviour and CHEAKS.

C.4 Evaluation of the 6-month education.

In this chapter, I developed and measured the effect of the 6-month EE workshop on elementary students. In addition, we measured using the CHEAKS model to understand relationships between student knowledge, attitude and behaviour intention after joining EE activities.

- Create a questionnaire to evaluate student knowledge before – after EE.
- Compare student knowledge by treatment - control design.

- Adopt theory of planned behavior model to measure the relationship between intention and attitude.
- Evaluate students' newspapers to understand their attention to EE activities.

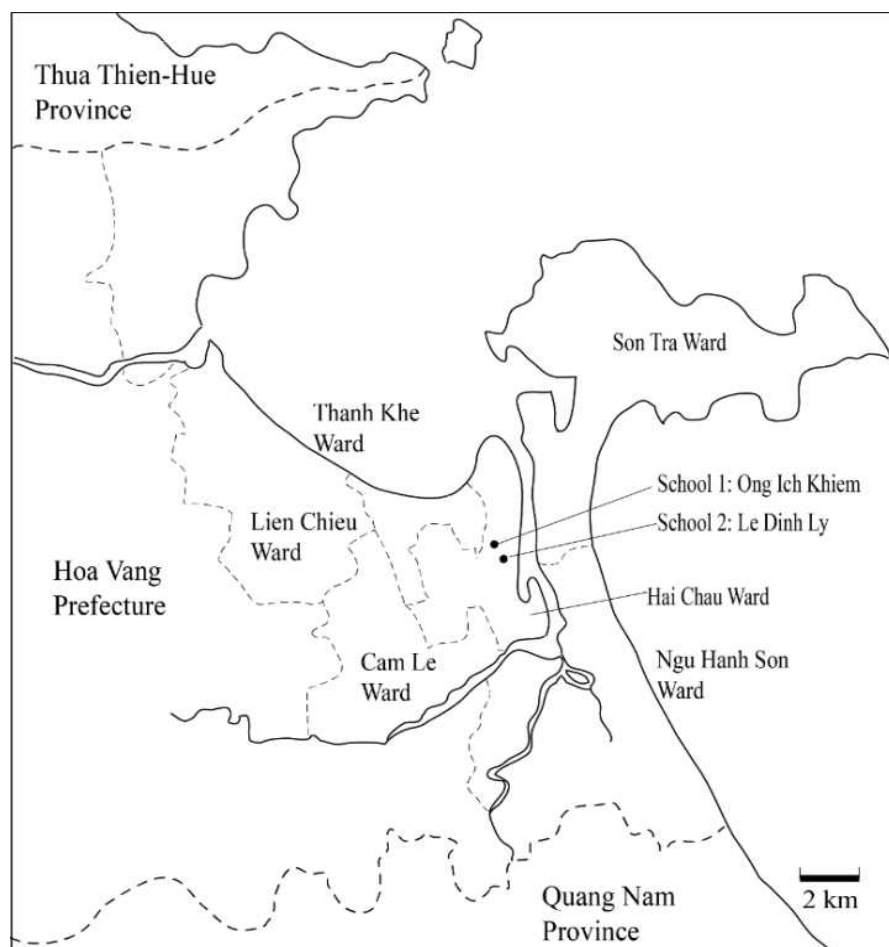
5.2 Methodology

5.2.1 The study subject selection

We surveyed 162 fourth grade students in 2 schools in Da Nang city, Vietnam. The study employed a treatment-control design where the treatment school was the main focus of the research. Our survey and experimental EE were done in two schools to account for differences and impacts of EE. Figure 5-1 shows the locations of the schools. These schools were chosen using the following procedure. First, we excluded the schools where the highest or the lowest level of education existed; our target was schools with an average educational level in the same environment. Second, we wanted to find 2 schools that had similar curriculums, environments, and socio-economic backgrounds to reduce the differences between student's environmental knowledge and environmental behaviour. Third, we tried to find two schools in the same ward that would be representative of the educational systems in Da Nang. Fourth, I chose two pairs of schools in the same ward in Hai Chau District. Fifth, I visited the four schools and asked the principal to participate in our EE and survey. One pair of schools joined our EE and survey, but the other pair of schools refused to join our EE but agreed to participate in survey activities. Sixth, from paired schools, we chose school 1 (Ong Ich Khiem) to be the treatment school and school 2 (Le Dinh Ly) to be the control school. School 1 agreed to join our EE, whereas school 2 only agreed to participate in survey activities. Seventh, each school had four 4th grade classes, from which we randomly choose 2 classes to participate in our EE in the treatment school and 2 classes for survey activities in the control school. Table 5-1 summarizes the total number of control and treatment students engaged in EE.

Table 5-1 Treatment and control school

	Treatment school		Control school	
Grade level	Class 4.1	Class 4.2	Class 4.1	Class 4.4
Number of students	37	40	44	41
Date	Tuesday, every 2 weeks	Tuesday, every 2 weeks	/	/
Period	1	3	/	/
Number of lessons	10	10	/	/
Time	14:00 ~ 14:30	15:50 ~ 16:20	/	/
Duration	6 months October, 2016 to March, 2017	6 months October, 2016 to March, 2017	/	/



** Copyright credit “Map data: OpenStreetMap”*

Figure 5-1 Locations of the schools surveyed

This study provided three questionnaire surveys and 6 months of EE activities to the 4th grade students of the control and treatment schools as indicated in Figure 5-2

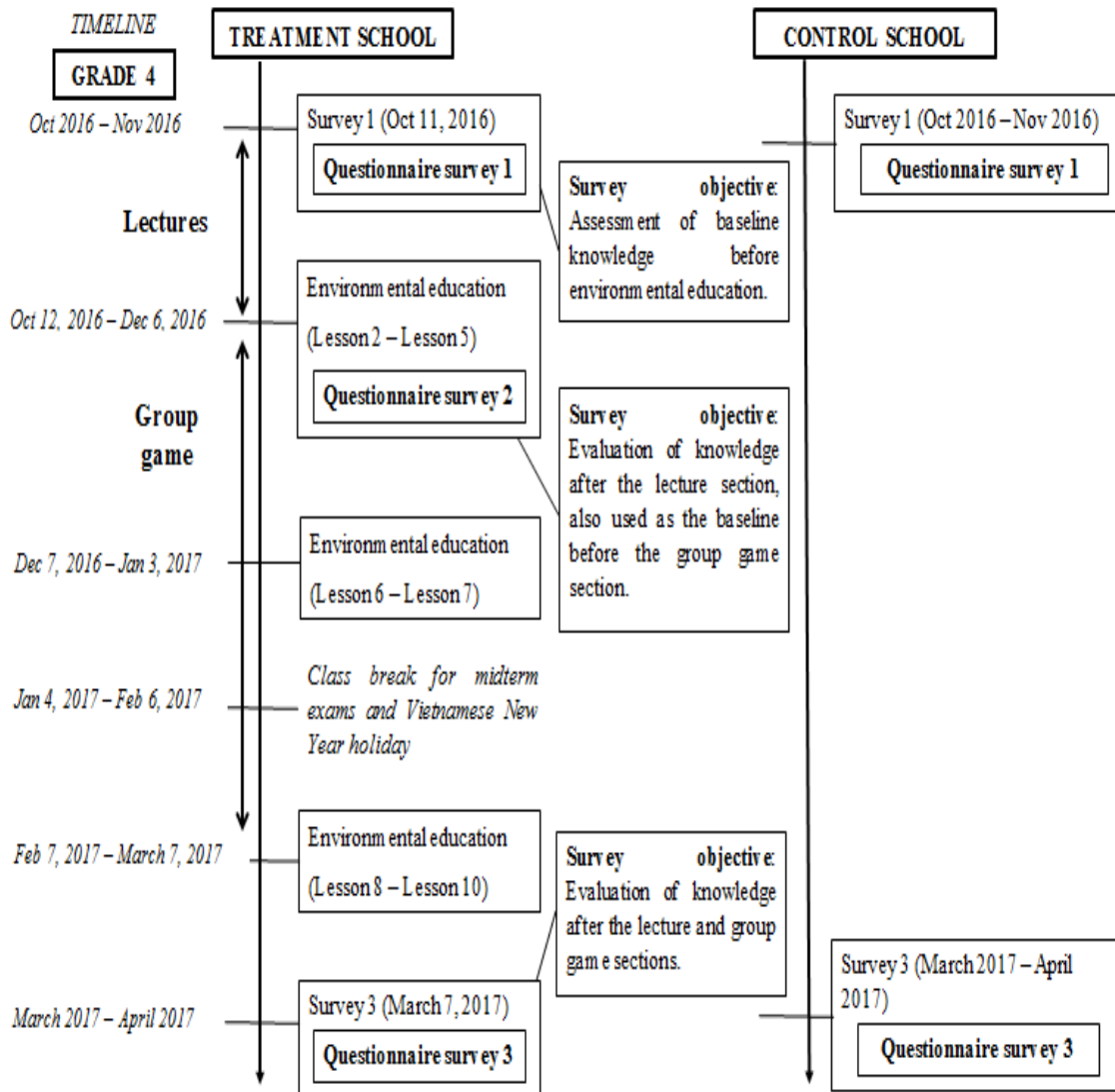


Figure 5-2 Research structure

The students answered the questionnaire in their classrooms. One of the authors came to the treatment school to administer the questionnaire surveys whereas in the control school, the teacher administered the questionnaire. The students had a maximum of thirty minutes to answer the questionnaire survey in their classrooms. This study started in October 2016 when students were in 4th

grade and continued for 6 months until March 2017. In the treatment school the questionnaire was completed in groups and the teachers were not allowed to help the students. In the control school we instructed the teacher not to assist the students in filling out the questionnaire.

5.2.2 Survey 1 (2016/10/11 – 2016/11/01)

The aims of this survey were to understand the knowledge level of control and treatment students before EE. To achieve this, survey 1 comprised a total of 162 students from 4th grade. Students answered 41 questions in 30 minutes.

In addition, we observed solid waste management practices of a Kitakyushu elementary school in Japan, and reviewed 4th grade textbooks to develop our questionnaire. We gave the questionnaire to two experts, the vice principal from an elementary school where we have done EE, and a member from the Faculty of Environment, Da Nang University of Science and Technology, to validate the content.

Our questionnaire survey had 2 main sections: Section 1 (from question 1 to question 31) is student attitude evaluation, and section 2 (from question 32 to question 41) is student knowledge evaluation. The study used a rating scale to evaluate student attitude towards the environment including solid waste management, energy saving, and water saving related questions. Table 5-2 shows a summary of the questionnaire for survey 1, 2 and 3.

Table 5-2 Summary of survey questions

Questions	Contents	Reference
Section 1: Questions 1 to 26 (Surveys 1 and 3)	<ul style="list-style-type: none"> - Students' attitudes toward waste management. - Five-level answer-scale. 	Factors of the Theory of planned behavior (Ajzen & Fishbein, Attitudes and the Attitude-Behavior Relation: Reasoned and Automatic Processes, 2000). CHEAKS (Children's Environmental Attitudes and Social Knowledge Scale) questions (Treagust D. F., Amarant, Chandrasegaran, & Won, 2016).
Section 1: Questions 27 to 31 (Surveys 1 and 3)	<ul style="list-style-type: none"> - Attitude comparison between Vietnamese and Japanese students. - Three-level answer-scale. 	Created by the authors.
Section 2: Questions 32 to 41 (Surveys 1, 2 and 3)	<ul style="list-style-type: none"> - Knowledge questions: 2 paper recycling, 1 landfill, 1 non-organic waste, 2 eco-bags, 2 recycle for profit, 1 food waste, and 1 3Rs. - Multiple-choice. 	Created by the authors reflecting lesson contents.

The attitude section was designed to examine how student intention to manage waste changed before and after EE from author. At the beginning, the study follows Theory of Planned Behavior by Icek Aizen (2002) to create the model to examine the intention. Figure 5-3 showed the model that the study modified to evaluate elementary student in Da Nang. In Vietnam, separation of waste is an informal activity and measuring the impact factor on student behavior was difficult. The factor of behavior in the Theory of planned behavior was not used because it was not observed.

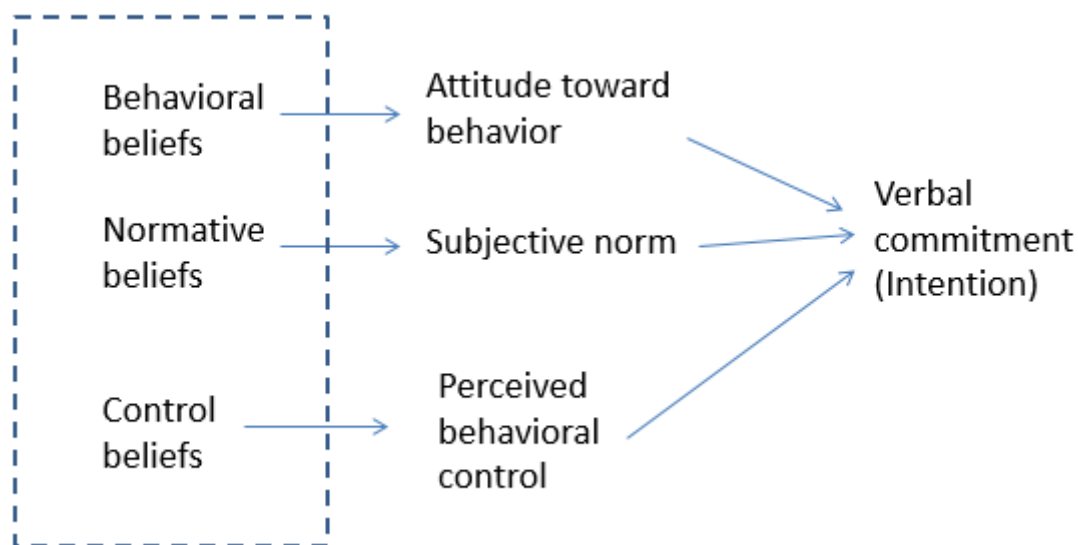


Figure 5-3 Modified model for Da Nang elementary

Questions to define the factors were taken and modified from Children's Environmental Attitude and Knowledge Scale CHEAKS (Leeming, Dwyer, & Bracken, 2010). In addition, the study used CHEAKS that was applied from "A Case for Enhancing Environmental Education Programs in Schools: Reflecting on Primary School Students' Knowledge and Attitudes" (Treagust D. F., Amarant, Chandrasegaran, & Won, 2016). As the study mentioned in the statement problem, Vietnamese elementary students did not have a basic understanding about solid waste management; participants in this study, elementary student had opportunity to practise the solid waste knowledge. The main EE activities in this study focused on solid waste management, the study wanted to define the factor that impact on student's attitude and intention. In addition, Vietnamese do not separate waste at home and all the waste is dumped to landfill. It will be difficult to define behaviour factor. The study created questions following 3 factors from "Theory of reasoned action and planned behaviour": Attitude toward behaviour, subjective norm and perceived behavioural control. The study defined the relationship of these factors to verbal commitment (VC). The questionnaire considered students' knowledge of

environmental issues (knowledge scale) and attitudes toward the environment (attitude scale). The attitude scale comprised four subscales and 26 questions: 8 questions reflected verbal commitment (VC), 4 measured attitude toward behaviour, 4 evaluate subjective norm and 6 assessed Perceived behavioural control. I adopted 6 similar questions from children's environmental attitude and knowledge scale shown in Table 5-3 (Leeming, Dwyer, & Bracken, 2010).

Table 5-3 Adoption questions from CHEAKS scale

Items
<p><i>Verbal Commitment</i></p> <p>1, I would not be willing to save energy by using less air conditioning. a. very true b. mostly true c. not sure d. mostly false e. very false</p> <p>2, to save water, I would be willing to use less water when I bathe. a. very true b. mostly true c. not sure d. mostly false e. very false</p> <p>3, I would not be willing to separate my family's trash for recycling. a. very true b. mostly true c. not sure d. mostly false e. very false</p> <p>4, To save energy, I would be willing turn off lights at home when they are not in use. a. very true b. mostly true c. not sure d. mostly false e. very false</p>
<p><i>Affect</i></p> <p>5, I do not worry about environmental problems. a. very true b. mostly true c. not sure d. mostly false e. very false</p> <p>6, I am not frightened about the effects of pollution on my family. a. very true b. mostly true c. not sure d. mostly false e. very false</p>

The study created another 20 questions following the contents of EE from the author. These attitudinal questions are distributed over 8 concepts: saving water, saving energy, eco-bags, food waste, reducing waste and separation waste and general issues. Example of questions is given in Figure 5-4.

Item		
Verbal commitment (intention)		
Water:	To save water, I would be willing to use less water when I bathe	VC1
Energy:	I would not be willing to save energy by using the air conditioning less	VC2
	To save energy, I would be willing to turn off the light when I go out	VC3
Eco-bag:	I would be willing to use eco-bags instead of nylon-bags to save the environment.	VC4
Separation waste:	I would not be willing to separate my family's waste for recycling.	VC5
Food waste:	I would be willing to give food waste to pig farms to reduce waste	VC6
Old clothes:	I would not be willing to reduce old clothes in my house to protect the environment	VC7
Reducing waste:	I would be willing to explain to my parents the importance of reducing waste	VC8
Attitude toward behaviour		
Eco-bag:	I always use eco-bags instead of nylon bags to save the environment	ATB1
Separation waste:	I never separate my family's waste	ATB2
Food waste:	I always give food waste to pig farms to reduce waste	ATB3
Old clothes:	I never reuse old clothes in my house	ATB4
Subjective norm		
General	I am not afraid about the effects of pollution on my family	SN1
	I do not afraid about solid waste problems	SN2
	It is important for me to follow the rules of society	SN3
Old clothes:	My family members always reuse old clothes	SN4
Energy:	My family members always save energy	SN5
Eco-bag:	My family members always use eco-bags to reduce garbage	SN6
Perceived behavioural control		
Separation waste:	Separation of waste is easy for me	PBC1
Eco-bag:	It is easy to carry the eco-bags when I go shopping	PBC2
	I do not like to use eco-bags when I go shopping	PBC3
		PBC4
Old clothes:	I do not like to wear old clothes	
Food waste:	I do not like to eat pork from pigs that were fed by food waste	PBC5
	It is easy to donate food waste to farmers to feed pigs	PBC6

Figure 5-4 Examples of questions from the CHEAKS attitude scale

Responses to the 26 questions in the attitude scale were based on five-level answer-scale with responses ranging from: (1) 'Wrong', (2) 'Maybe wrong', (3) 'Not sure', (4) 'Maybe right' and (5) 'Right'.

In the knowledge section, multiple-choice questions were given to students before and after EE activities to evaluate the change in student

knowledge. Ten knowledge evaluation questions included 2 questions about recycling paper, 1 landfill question, 1 non-organic waste question, 2 questions for eco-bags, 2 recycle for profit questions, 1 food waste question, and 1 3Rs question. Four questions analysed student's knowledge with respect to landfilling, eco-bags, 3Rs, and recycle for profit. 3Rs and recycle for profit which were new concepts for students, were introduced in the EE activities from the author. Two other question addressed landfilling and eco-bags, which are basic knowledge topics that students are exposed to in their daily lives. The study was conducted to evaluate the impact of EE from the author and from other channels comparing outcomes in control and treatment school settings.

Please circle your answers:

Question 33: In Da Nang where does most of the waste go after it is collected from collection area?

- (a) To an aquifer where it is buried
- (b) It is dumped into ocean
- (c) It is recycled to make plastic
- (d) To a Khanh Son landfill**
- (e) To farmers who use it as fertilizer

Question 35: What is an eco-bag?

- (a) A nylon bag that can be used only once
- (b) A paper bag that can be used only once
- (c) A cloth bag that can be used only once
- (d) A plastic bag that can be used only once
- (e) A plastic bag or cloth bag that can be reused many times**

Question 37: What does 3Rs mean?

- (a) Recycle, reuse and reduce waste**
- (b) Throw waste in the rubbish bin
- (c) Recycle, reuse and separation of waste
- (d) Reuse and reduce waste
- (e) Protect the environment

Question 38: Why do we need to recycle?

- (a) To reduce the amount of waste that goes to a landfill**
- (b) To earn money
- (c) For fun
- (d) For school donations
- (e) To reduce space

Underlined options are assumed correct answers

Figure 5-5 Questions about solid waste management.

This study employed the same questions as those in survey 1 (October, 2016), survey 2 (November, 2016), and survey 3 (March, 2017) to measure student's knowledge. Bolded and underlined answers indicate the correct responses to the questions.

5.2.3 Environmental education activities during 6 months and survey 2

Between October 2016 and March 2017 we provided 10 lessons in solid waste management to two 4th grade classes in elementary schools in Da Nang city. As there are cultural differences between Japanese and Vietnamese systems for elementary schools, the EE activities were designed taking these differences into account resulting in an increase in Vietnamese student's environmental knowledge. The study followed the Japanese teaching model to create 10 lessons for Vietnamese elementary school students. Table 5-4 shows the environmental activities guidelines that this study created to use with Vietnamese elementary students. Accounting for difference in size of classroom, Vietnamese elementary students in this study were separated into 16 groups in 2 classrooms. More information about differences in elementary EE programs between Japan and Vietnam may be found in another paper from the author (Phan Hoang & Kato, 2018). The study used the workshop model to teach and promote EE activities in elementary schools. The workshop technically has 4 steps: Warm up (lesson 1), mini-lesson (lesson 2 to 5), independent work time (lesson 8 to 9) and a share session (lesson 10).

Table 5-4 Environmental activities guideline

Lesson	Title	Objectives	Summary statement and guidelines
1	Introduction	Give students basic information about solid waste management to be taught over the next 9 lessons. Students will complete questionnaire survey to evaluate their knowledge before lesson.	Students must have basic understanding of goals and practice of the EE in 10 lessons. Questionnaire survey must assume student's knowledge before they join EE activities.
2	Solid waste management situation in Da Nang city	Understand student's knowledge about the situation of solid waste in Da Nang city. Introduce students to the situation of solid waste management in Da Nang city.	Educators must have a basic understanding of the goals, situation, local activities, and history of the EE field in the province where the school is located.
3	3Rs (reduce, reuse, and recycle)	Introduce 3Rs concepts to students.	Educators must show students local 3Rs application.
4	Recycle product	Introduce recycle products to students. Teach students how to make toys from waste.	Educators must encourage students to talk and show their recycling produce.
5	Food waste situation in Da Nang city	Introduction to food waste systems in Da Nang city. Introduce food waste systems in general.	Educators must have a basic understanding of the goals, situation, local activities, and history of food waste management in local area.
6	Waste separation game	Give students the opportunity to practice waste separation. Go over material taught during the last 5 lessons.	Student must understand waste separation system in the local area. Student must identify kinds of waste.
7	Newspaper game	Understand student thinking about the environment. Review information that they studied.	Students should have time to discuss the contents and assign individual task.

8	Newspaper game and student presentation	Understand student's ideas for their newspaper.	Evaluate student's presentations, including recorded presentations on a voice recorder where educator used notes from the author.
9	Newspaper presentation activities.	Understand student's idea for their newspaper.	Evaluate student's presentations, including recorded presentations on a voice recorder where educator used notes from the author.
10	Final class.	Give students comments about their newspaper. Review EE material that they studied. Give students prizes for their activities.	Educators must understand and evaluate students after activities.

Survey 2 used six questions from the knowledge question section (from question 32 to question 41) to evaluate student's knowledge after EE at lesson 4 that showed in Figure 5-6.

Six questions that used in survey 2

33. In Da Nang where does most of the waste go after it is collected by waste trucks?

- (a) To an aquifer where it is buried
- (b) It is dumped into ocean
- (c) It is recycled to make plastic
- (d) To a Khanh Son landfill
- (e) To farmers who use it as fertilizer

34. Items that cannot be recycled and used again are:

- (a) Newspapers
- (b) Cans
- (c) Bottles
- (d) Glasses
- (e) Cigarette wastes

37. What does 3Rs mean?

- (a) Recycle, reuse and reduce waste
- (b) Throw waste in the rubbish bin
- (c) Recycle, reuse and separation of waste
- (d) Reuse and reduce waste
- (e) Protect the environment

38. Why do we need to recycle?

- (a) To reduce the amount of waste that goes to a landfill
- (b) To earn money

- (c) For fun
- (d) For school donations
- (e) To reduce space

39. The main reason for using eco-bags is:

- (a) To recycle waste
- (b) For their ease of use
- (c) To reduce the amount of nylon-bags, protect environment
- (d) For fashion
- (e) To save money when we shopping

41. What should you NOT do with food waste?

- (a) Throw it away
- (b) Use it to feed pigs
- (c) Make fertilizer
- (d) Make biogas
- (e) Reduce food waste

Figure 5-6 Questionnaire survey 2

During independent work time (lessons 7, 8 and 9), students in the treatment school participated in a “newspaper game” where students wrote and promoted their ideals about their environmental knowledge from the previous 4 lessons. Topics of the workshop were “can you draw or write your ideas on how to protect the environment using what you studied at school, incorporating family and daily life”. The students could use knowledge from the author’s lessons, from the school’s textbook, or from their daily life to create their newspaper. The author had 30 minutes for each lesson after which there was a 5-minute break. In lesson 7, students had 35 minutes for group discussion and to make their

newspaper. The author provided the materials used to make the newspaper with some students sharing paper and crayons. In lesson 8, students had 10 minutes to complete their newspaper and prepare to present it in front of the class. When one group presented, the other group would listen and prepare questions for discussion. The presenting group of students controlled the classroom when they made their presentation, and all the group members needed to present their involvement in creating the newspapers. The author used voice recordings and took notes to record the contents of the newspaper presentation from students. At the beginning, students in the treatment school were separated into 8 groups (per class) where each group had 4 or 5 students. In lesson 7, the treatment school students had time to draw and write their thoughts about the environment on A3 paper. Students had 10 minutes in lesson 8 to complete their newspaper and prepare for their presentation. The author had to control the presentation time for each group maintaining 5 minutes to present and 2 minutes for questions and answers. Three groups made presentations in lesson 7 and the remaining 5 groups presented their newspaper in lesson 9. In this newspaper activity, the students received small gifts to motivate them in continuing with environmental studies. The author used a 10-point scoring system to evaluate each presentation, with 5 points for contents of the newspaper and 5 points for the presentation. Representatives from each group played a “raffle game”, to randomly select the order for making presentations. To evaluate the student’s newspapers, voice recording and note from student’s presentations were used to evaluate the newspaper texts, in addition to students’ drawings. Children usually explore the world around them through intellectual, physical and emotional methods. For young children pencil, brush and paper are the best means of conveying their fondest hopes and most profound fears (Masoumeh & Masoud , 2011). The progression of drawings that children make over a period of time can show significant growth and development, as well as determine academic capabilities

and skills, characteristic of their developmental level (Masoumeh & Masoud , 2011).

5.2.4 Survey 3 (2017/03/07 – 2017/04/01)

This survey aims to evaluate the impact of EE activities done over 6 months. Survey 4 involved students from treatment and control schools to evaluate the difference between students who took the EE workshop and those who did not.

5.2.5 Analysis of student newspaper

Some of the modernized teaching approaches are informal discussion, concept maps, drawings and more. When drawing, students are given the opportunity to show their mental picture much better than in verbal or written expressions (Dempster & Stears, 2013). Drawing is an even more relevant tool in assessing student understands if it is accompanied by written commentary (Chin & Teou, 2009).

The main task of this study was to estimate the impact of the workshop model on environmental teaching, reflected in the creation of the student newspapers. The outcome of the research was monitored through the analysis of student drawings on the topic “How can I protect the environment?”

The study used 2 methods to analyse the data that was collected from student newspapers: Observed material in student newspapers and data collected from student presentations, were analysed using standard statistical methods.

Firstly, it is important to constantly pay attention to the first impression of a drawing. Second, at an early age, the themes of the drawings are secondary, and the drawing activities are performed in a dimension where the entire psychological and physical activities are united. However, when children become slightly older, the theme becomes more important (Farokhi & Hashemi, 2011).

The categories in the environmental protection Coding List have been defined as "environment", "people", "plants", "animal", "abiotic elements",

"buildings/vehicles", "dirty environment elements", "clean environment elements", and "natural events". Günindi (2012) prepared 51 categories, but this study only used 12 categories to analyse the data about perceptions of environment (Günindi, 2012).

5.3 Results

5.3.1 The impact to the student knowledge

In the method section, it was mentioned that the study surveyed a total of 162 students. However, just 157 students joined surveys 1 and 3, comprising 72 students in the treatment school, and 85 students in the control school.

Table 5-5 Number of students involved in the study

	Treatment school	Control school
First survey	77	85
Third survey	77	86
Common the two surveys	72	84

In survey 1, the study did not find a significant difference between treatment school and control schools. The results of chi-square are shown in Table 5-6. Figure 5-7 shows the percent of students who gave the correct answers. Control and treatment schools have similar knowledge about solid waste management at the beginning.

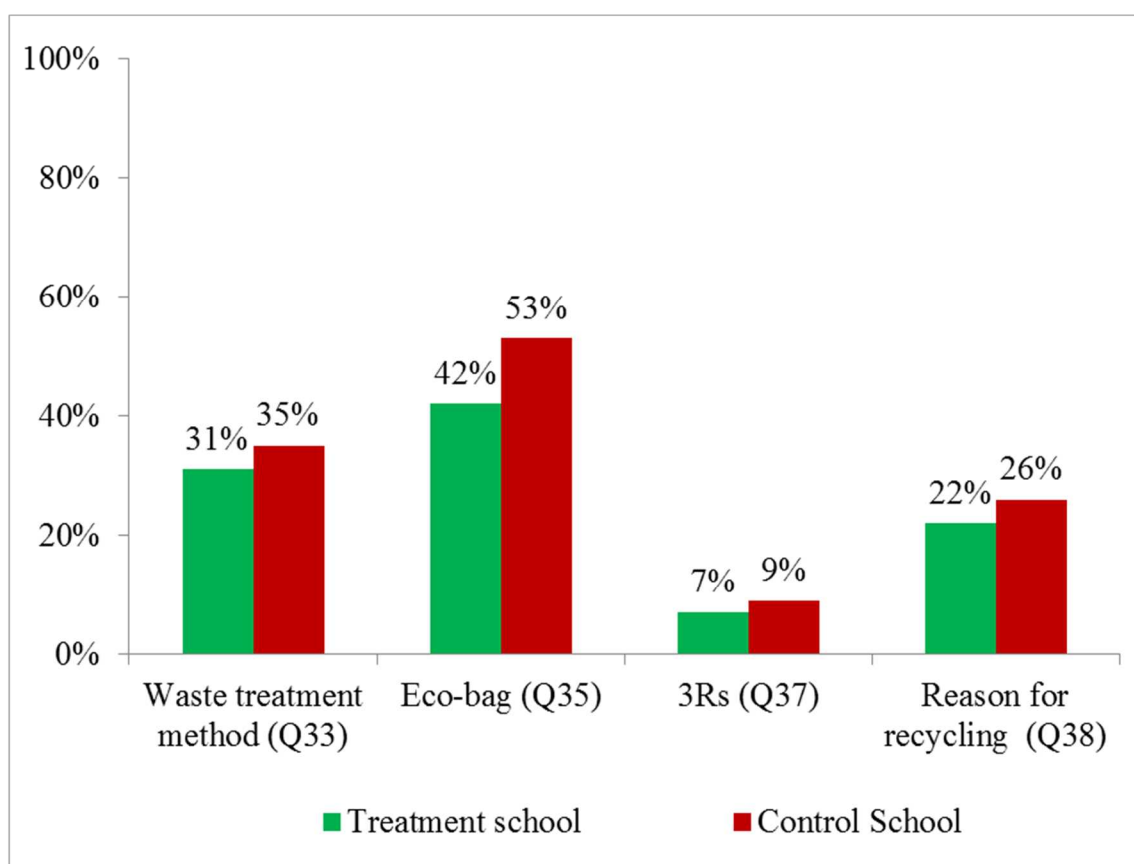


Figure 5-7 Treatment and control student's knowledge about solid waste management at survey 1

Table 5-6 Chi-square test for Figure 5-7 (before environmental workshop)

Knowledge	Control school	Treatment school
Waste treatment method	$X^2(1) = 0.395, P = 0.611$	
Eco-bag	$X^2(1) = 1.986, P = 0.200$	
3Rs	$X^2(1) = 0.312, P = 0.773$	
Reason for recycling	$X^2(1) = 0.258, P = 0.709$	

After survey 1, we did a 6-month workshop for EE at the treatment school. Figure 5-8 and Table 5-7 show a comparison before and after the environmental education period for the treatment and control schools, respectively. The paired T-test was conducted to compare student knowledge about the waste treatment method, eco-bags, 3Rs and reason for recycling in survey 1, before environmental education and survey 3, and after environmental education for the same students in treatment and control schools. The study found significant

differences in student knowledge between treatment and control schools located in the center of Da Nang city as shown in Table 5-6.

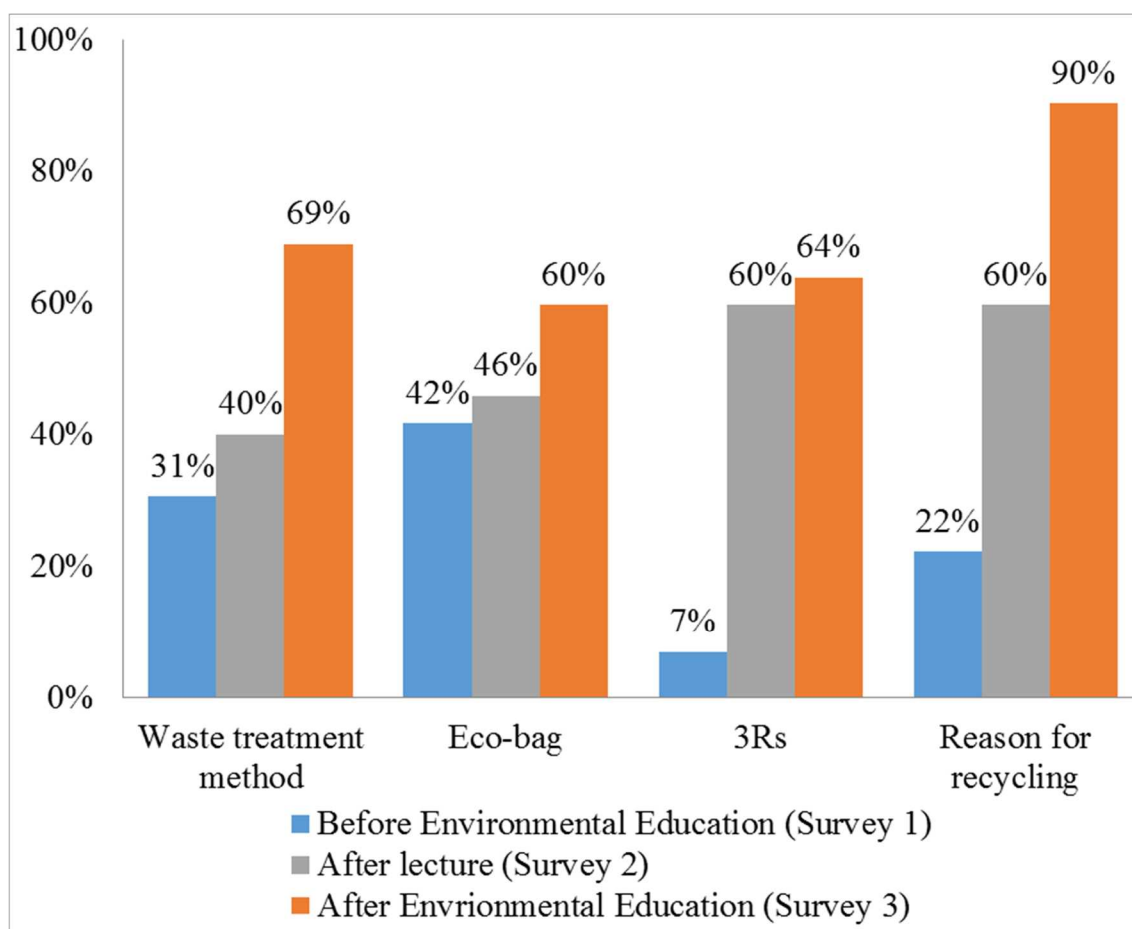


Figure 5-8 Treatment school student knowledge about solid waste management

Table 5-7 T-test results for Figure 5-8

Knowledge	Comparison	T-test
Waste treatment method	Survey 1 and 2	T(72) = -9.690, P = 0.000
	Survey 1 and 3	T(72) = -5.549, P = 0.000
	Survey 2 and 3	T(72) = 2.840, P = 0.006
Eco-bag	Survey 1 and 2	T(72) = -0.597, P = 0.552
	Survey 1 and 3	T(72) = -2.712, P = 0.008
	Survey 2 and 3	T(72) = -1.856, P = 0.067
3Rs	Survey 1 and 2	T(72) = -8.055, P = 0.000
	Survey 1 and 3	T(72) = -9.184, P = 0.000
	Survey 2 and 3	T(72) = -0.536, P = 0.593
Reason for recycling	Survey 1 and 2	T(72) = -4.989, P = 0.000
	Survey 1 and 3	T(72) = -9.184, P = 0.000
	Survey 2 and 3	T(72) = -4.528, P = 0.000

Figure 5-8 shows that regarding the waste treatment method, 3Rs and the reason for recycling questions, more than 50% of the students improved to give the correct answer from survey 1 to survey 3 in the treatment school. The degree of improvement is small for the eco-bag question. Many students already knew about eco-bags before the beginning of this educational activity, but it was difficult for the rest of the students to grasp this idea through this education. A comparison between surveys 1 and 2 shows the results of the lectures. These lectures statistically improved knowledge on waste treatment methods, 3Rs and the reason for recycling significantly at the 5% level. A comparison between surveys 2 and 3 shows how the group games improved student knowledge. Statistically, knowledge of the waste treatment method and the reason for recycling significantly increased after the group games. Thus, the effects of lectures and group games were different across different waste management knowledge.

After lectures, students' knowledge slightly increased from 31% to 40% on waste treatment method, and 42% to 46% on eco-bag. More so, after the group game and newspaper activities, waste treatment method increased from 40% to 69%, and eco-bag 46% to 60%. We found that with basic knowledge the effects of the group games were stronger than lectures. But for new advanced knowledge like 3Rs, lectures were important for students. We found that, because Vietnam does not have separation systems at the source, students got confused with knowledge about reducing and reusing waste, which are elements of 3Rs. In the newspaper game, students seldom discussed 3Rs. Also, we found that a reason for recycling was new advance knowledge, but students had practiced recycling at home without clearly recognizing why. Thus, both lectures and games improved knowledge on the reason for recycling. The study showed that lectures influenced new knowledge of solid waste management more than games. The knowledge that is related to daily life is more influenced by group games than lectures.

A study in Poland compared 4th-6th grade elementary students' knowledge of waste before and after a series of waste management group work. Its results showed that recognition of recycling increased from 42% to 79%, whilst correct answers on the present treatment method in the country increased mildly from 57% to 64% (Grodzinska-Jurczak, Bartosiewicz, Twardowska, & Ballantyne, 2003). In this study, we found that depending on the types of solid waste knowledge, lecture and group work can have different impacts. A study in Trento, Italy in three schools showed that the production of waste does not only depend on the size of the institutes in terms of students, teachers and other employees but especially on the types of activities carried out in addition to the ordinary lectures (Rada, Bresciani, Girelli, & Ragazzi, 2016). Thus, combining practice activities with lectures should positively impact student knowledge that is related to daily life.

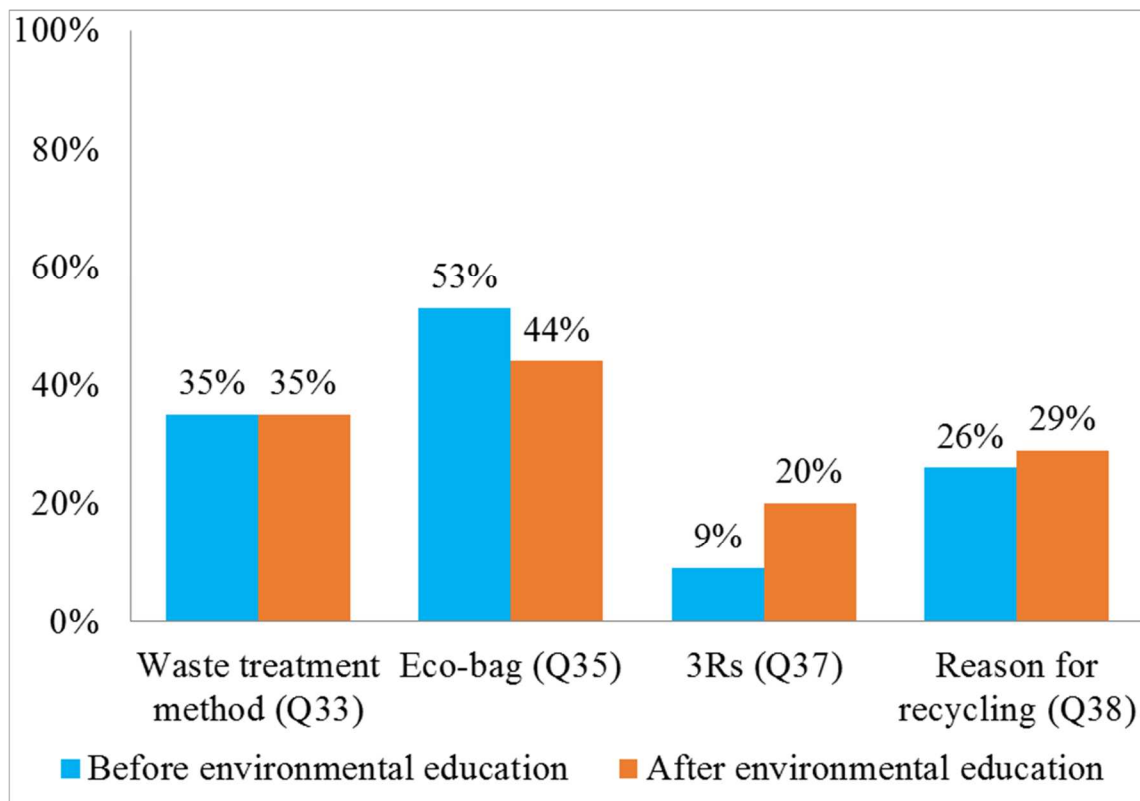


Figure 5-9 Control school student knowledge about solid waste management

From the pre-survey in 2014, the study found that no solid waste management knowledge appeared in the Vietnamese school textbook. The students did not understand the situation of solid waste in Da Nang city. More details about Vietnam education system and textbook can be found from in our last publication (Phan Hoang & Kato, 2016).

Table 5-8 T-test results for the control school in Figure 5-9

Knowledge	Comparison	T-test
Waste treatment method	Survey 1 and 3	T(84) = 0.000, P = 1.000
Eco-bag	Survey 1 and 3	T(84) = 1.379, P = 0.171
3Rs	Survey 1 and 3	T(84) = -1.9058, P = 0.060
Reason for recycling	Survey 1 and 3	T(84) = -0.3633, P = 0.717

There was no significant difference in the scores for the student's knowledge in the control school as shown in Table 5-8. The study found that there was no solid waste education for 4th grade students, even at the elementary level in Vietnam.

Among 157 students from control and treatment schools in the survey 1, only 7% of students in the treatment school and 9% in the control school knew about 3Rs; 22% student in the treatment school and 26% in control school knew reason for recycling.

As reflected in survey 3 (March, 2017), after 6 months of environmental education activities, student's knowledge in the treatment school increased by 64% for 3Rs and 90% for reason for recycling. Student knowledge in the control school did not change and decreased when compared with survey 1 by 9% for 3Rs, and by 9% for reason for recycling.

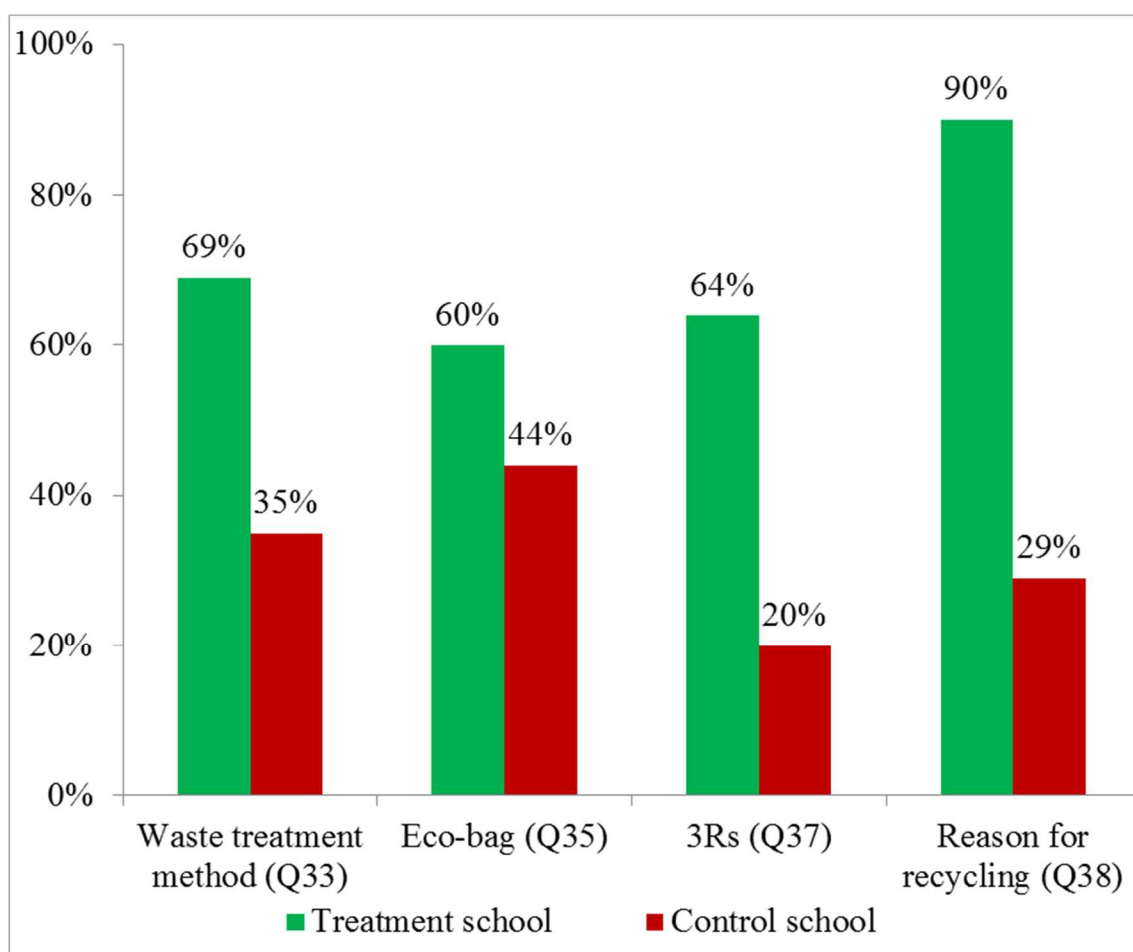


Figure 5-10 Control and treatment schools student knowledge about solid waste management

Table 5-9 Chi-square test for after environmental workshop of Figure 5-10

Knowledge	Control school	Treatment school
Waste treatment method	$X^2(1) = 18.191, P = 0.000$	
Eco-bag	$X^2(1) = 4.090, P = 0.050$	
3Rs	$X^2(1) = 31.253, P = 0.000$	
Reason for recycling	$X^2(1) = 59.031, P = 0.000$	

From the chi-square test, the study found significant differences between student knowledge in control and treatment schools. After 4 lessons and 6 environmental activities done in the classrooms, student in the treatment school had more right answers than those in the control school.

The study did not find any significant difference between the classes, or between genders in survey 1 and survey 3 with respect to student environmental knowledge.

In addition, I made comparison between survey 1, survey 2 and survey 3 of treatment school to understand the changing of student knowledge before EE (survey 1) with after lecture lessons (survey 2) and after EE (survey 3) . The study found significant difference between survey 1 and survey 2 at the treatment school. The student increased their solid waste management knowledge after EE activities provided by this study.

Table 5-10 T-test results between survey 1 and survey 2 from treatment school

Knowledge	Comparison	T-test
Waste treatment method	Survey 1 and 2	T(72) = -1.187, P = 0.239
Recycle items	Survey 1 and 2	T(72) = -3.185, P = 0.002
3Rs	Survey 1 and 2	T(72) = -8.055, P = 0.000
Reason for recycling	Survey 1 and 2	T(72) = -4.990, P = 0.000
Eco-bags	Survey 1 and 2	T(72) = -5.172, P = 0.000
Food waste	Survey 1 and 2	T(72) = -6.944, P = 0.000

The study did not find significant difference between survey 2 and survey 3, accepted question 38 (recycle for profit). The results were shown in Table 5-11.

Table 5-11 T-test results between survey 2 and survey 3 from treatment school

Knowledge	Comparison	T-test
Waste treatment method	Survey 2 and 3	T(72) = -3.637, P = 0.000
Recycle items	Survey 2 and 3	T(72) = 1.043, P = 0.300
3Rs	Survey 2 and 3	T(72) = -0.536, P = 0.593
Reason for recycling	Survey 2 and 3	T(72) = -4.687, P = 0.000
Eco-bags	Survey 2 and 3	T(72) = -1.856, P = 0.067
Food waste	Survey 2 and 3	T(72) = 0.851, P = 0.397

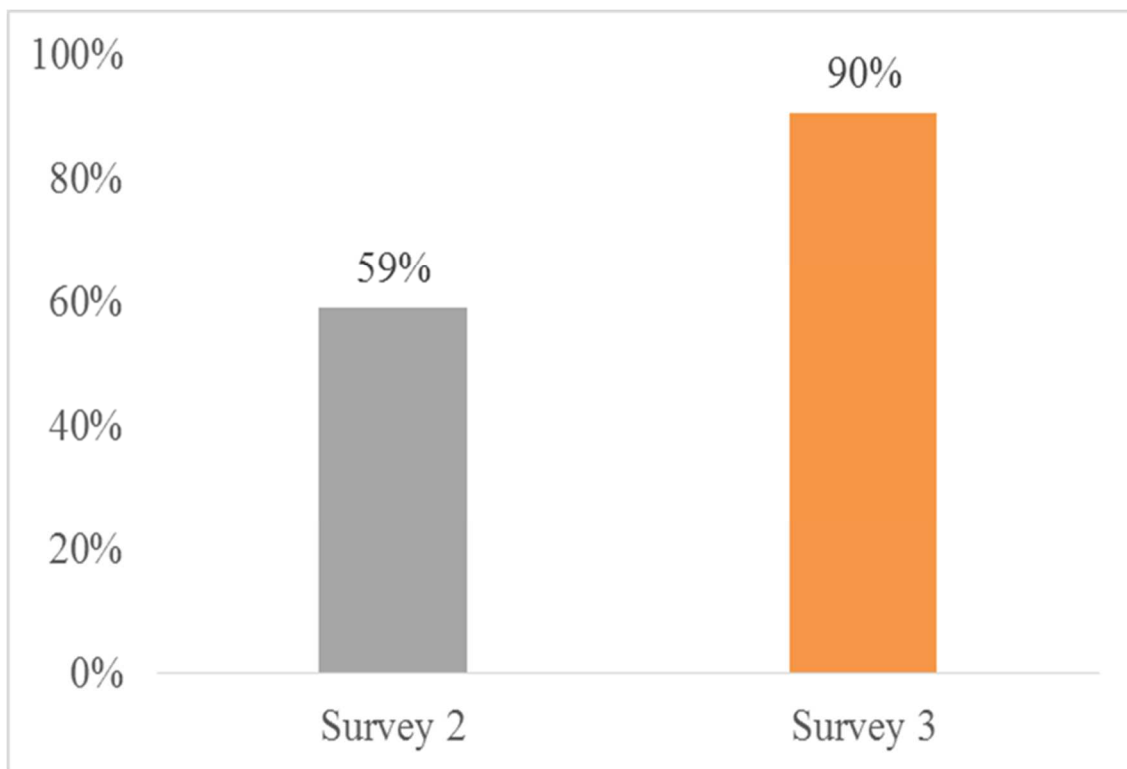


Figure 5-11 Showed difference of "Reason for recycling" question

As we can see from Figure 5-11, student's knowledge increased for "reason for recycling" after 2 months of EE lessons. From survey 2 to survey 3, I did 2 EE activities: (1) separation waste and (2) newspaper activities. I observed that students changed their knowledge because of the practice activities.

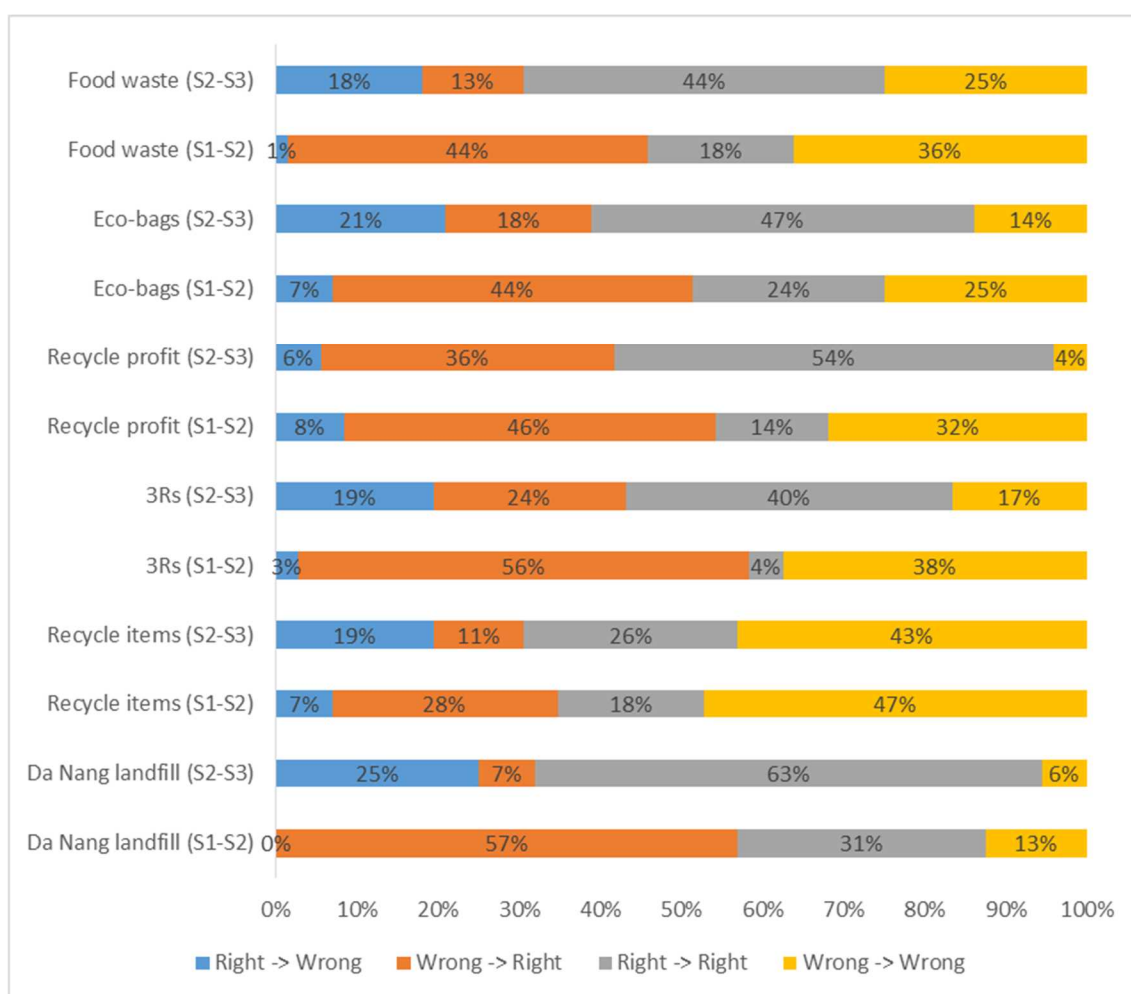


Figure 5-12 Changing of student answers between survey 1-survey 2 and survey 2-survey 3

The study assessed student answers between survey 1 - survey 2 and survey 2 - survey 3 to evaluate the change in students after EE and 2 months from EE lessons. We can see from Figure 5-12 that before EE lesson (survey 1) and after EE lesson (survey 2) 57% changed from wrong to right answer in waste treatment method question and 56% for the 3Rs question. In addition, the percentage that changed from wrong to wrong answer reduced between survey 2 (after EE lesson) and survey 3 (2 months after EE lesson). For the reason to recycling question, it was 32% between survey 1 and survey 2 and reduced to 4% at survey 3. The EE workshop had a good impact on student for solid waste management knowledge. The study found that just 8% keep the right answer in

question “recycle items”. From the study observation, we found no separation systems in Vietnam, therefore the student did not have a chance to practise and understand the reason for recycling concepts. In this question, student gave answers according to their daily life behaviour.

5.3.2 Student newspaper results

Two classes from the treatment school made 16 newspapers, of which 5 contained hand-drawn artwork only, and 11 contained a combination of hand-drawn artwork and text. From the student newspapers, the study found that 4 groups chose “protect environment”, 8 groups chose “reduce waste”, 4 groups chose “organic waste and non-organic waste”, 2 groups chose “3Rs” and 1 group chose “keep environment clean” as the main title of their newspaper. The study observed that 10 newspapers had drawings of human activities related to protecting the environment. For example: People cleaning the environment together, people carry eco-bags when they go shopping and people separate and dispose of garbage in the correct place. The author found that 2 groups mentioned promoting this environmental workshop in communities. In addition, 4 groups of student presented that we should separate waste and give food waste to farmers to raise pigs, or sell recyclable waste to waste scavengers. In Vietnam, we do not have a formal waste separation and treatment system. As such, all the waste goes to the landfill site by trucks. This is one of the reasons why the 3Rs project was not successful in Ha Noi city (Japan International Cooperation Agency, 2018). In this method the author wanted to use treatment systems in the local context of education such as: use of organic food waste to raise pigs, or sell recyclable products to waste scavengers. The study strives to promote in situ treatment systems that are present in the student’s daily environment. The main aim is practicing and applying environmental knowledge in daily life. The study considered that as much as the student can practice their knowledge in their life, the student could change their attitude and their intention. The study does not aspire for Vietnam to have a treatment system similar to that of Japan. The study

did not apply all contents from the Japanese context to be taught to Vietnamese students. The environmental education contents from the author focused on the current situation in local areas and the change in practical behaviours for students. We hope that the students can promote the workshop contents to their friends and family.

LESSON CONTENTS			NEWSPAPER CONTENTS	
LESSON	KEYWORDS	STYLE	NUMBER OF GROUPS	CONTENT
2	Waste problem	Picture	0	- Waste problem is one of the environmental problems. - Waste problem generate pollution and sickness.
		Text	6	
		Total	6	
	Solid waste management situation in Da Nang	Picture	0	- Khanh Son landfill will reach capacity soon. We should have a solution to reduce the waste discharged.
		Text	2	
		Total	2	
	Clean environment	Picture	4	- Pictures show people cleaning the environment.
		Text	1	
		Total	5	
3	3Rs	Picture	0	- Students write about contents of 3Rs that they studied.
		Text	3	
		Total	3	
	Separate waste	Picture	2	- We should separate waste to protect environment.
		Text	4	
		Total	6	
	3 kinds of waste	Picture	5	- 3 kinds of waste: organic waste, non-organic waste can recycle, and non-organic waste cannot recycle.
		Text	4	
		Total	9	
4	Eco bag	Picture	1	- Students draw people shopping with the eco-bag.
		Text	1	
		Total	2	
	Recycle waste	Picture	1	- Recycling waste can reduce the waste discharged to the environment.
		Text	4	
		Total	4	
	Throw waste in correct place	Picture	5	- We should throw waste in right place to protect environment.
		Text	4	
		Total	9	
5	Food waste	Picture	1	- Picture shows people using food waste to feed pigs.
		Text	1	
		Total	2	

Figure 5-13 Student newspaper contents summary

According to the notes and voice recordings from student's presentations, the author made a short summary about the contents of the student's newspaper following the contents from class lessons, as shown in Figure 5-13.

Figure 5-14 shows frequency of environmental keywords that appear in student's newspapers. The study found that some keywords always appear at the same time in the newspaper. For example: 3 kinds of waste often appear with separate waste or throw waste in right place

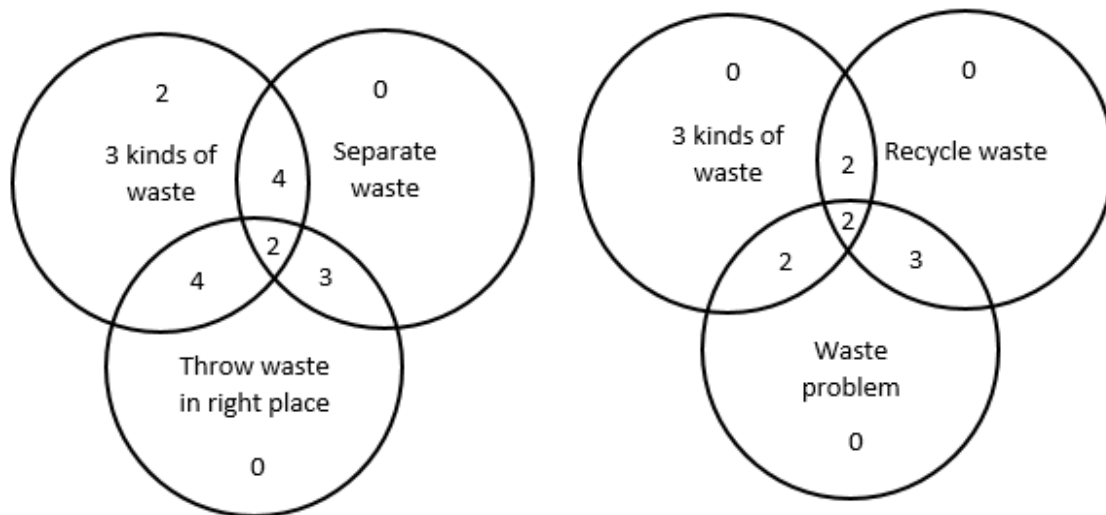


Figure 5-14 Frequency of keywords appearing in student's newspapers

In addition, a total of 12 codes were collected as a result of the analysis of the data obtained from the study. The students generally included people; various plant-types such as trees, flowers, and fruits; abiotic elements such as sun and clouds and rivers in their drawings. The elements that the students draw in the newspaper and the frequency of these elements are given in Table 5-12.

Table 5-12 Elements included in their drawings by students participating in the study

Code	Observation	
	Frequency	%
Environment		
Dirty	1	6.0
Clean	6	37.5
Total	7	43.5
PEOPLE	12	75.0
PLANTS		
Tree	8	50.0
Flower	4	25.0
Grass	2	12.5
Fruit	7	43.5
ANIMAL	1	6.0
ABIOTIC ELEMENTS		
Cloud	4	25.0
Sun	3	18.8
River	2	12.5
BUILDINGS/VEHICLES		
Truck	4	25.0
DIRTY ENVIRONMENTAL ELEMENTS		
Rubbish	16	100.0
Dustbin	10	62.5
CLEAN ENVIRONMENTAL ELEMENTS		
Recycle	4	25.0
Park	7	43.5

The majority of the students drew a rubbish (100%) or dustbin (62.5%), 75% included people, 50% included trees and 43.5% included fruits and parks.

The environment is the surroundings that people live in their whole life, so most of pictures from students included people with activities to keep the environment clean (Günindi, 2012). When students thought about protecting the environment, they always thought about the rubbish, and keeping the environment clean.

The study considered making a student magazine that included the student's newspapers. The author wanted to give the magazine to the school and student's families to promote activities at school. Because this study comprised private activities and the workshop had ended, we did not have enough time to create the magazine. In the near future, the study will provide a magazine to promote environmental improvement activities after the activities to student's families.

5.3.3 Factors of intentions to participate in solid waste management

The structural equation modelling (SEM) technique is used to estimate the waste management intention model from this study.

We used the following criteria to ascertain a good model fit:

(1) The relative chi-square ratio (χ^2/df) should not exceed 5 (Wheaton, Muthen, Alwin, & Summers, 1977).

(2) The root mean square error of approximation (RMSEA) should fall below 0.08 (MacCallum, Browne, & Sugawara, 1996).

(3) The values obtained for both the comparative fit index (CFI) should be > 0.9 (Hu & Bentler, 2009).

5.3.3.1 Estimation of original model for survey 1 (Model 1)

We estimated the model using 24 items, which indicated four dimensions: attitude toward behaviour, subjective norm, perceived behavioural control and VC. Model 1 treated all 24 items. These models we use combine data from treatment - control school at survey 1.

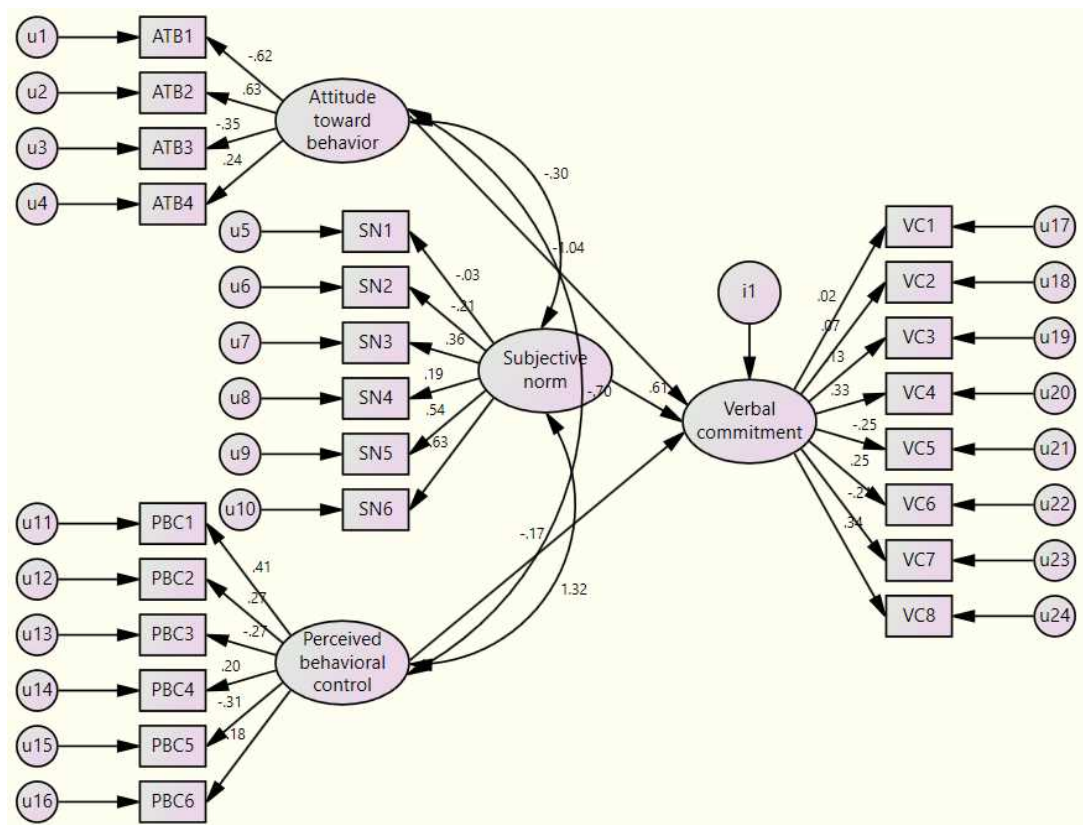


Figure 5-15 standardised results of structural equation model 1

Table 5-13 present descriptions and model fit indices for the entire model tested. Model 1 was not acceptable which χ^2/df (CMIN/df) = 1.602 < 5, RMSEA = 0.102 > 0.8 and CFI = 0.460 < 0.9. We rejected the null hypothesis that the model fits the data.

Table 5-13 Model fit of alternative models tested.

Model	Number of factors	Chi-square test			CMIN/DF	CFI	RMSEA
		X ²	Df	p			
1	4	463.309	246	0.000	1.883	0.460	0.102
2	4	46.466	27	0.021	1.602	0.905	0.062
3	4	51.133	29	0.007	1.763	0.850	0.103
4	4	95.304	83	0.168	1.148	0.936	0.045
5	4	45.105	31	0.049	1.455	0.901	0.073

5.5.3.2 Modification of model structure for survey 1 (Model 2)

After running model 1, the study found that the 24 items were not acceptable in the model. The study was designed to run an Exploratory Factor Analysis to test the relevance of the factors of survey 1.

Maximum likelihood analysis with varimax rotation was conducted to assess the underlying structure for the 24 items of the EE attitude scales. Four factors were requested based on the fact that the items were designed to index four constructs: BV, attitude toward behaviour, subjective norm, and perceived behavioural control. At survey 1 the treatment and control schools had the same situation, so we pooled the data from treatment-control schools. Table 5-14 displays the items and factor loadings for the rotated factor at survey 1.

Indicators that did not correlate significantly with their corresponding factor were eliminated following results from EFA in Table 5-14. The indicators “food waste” and “old clothes” were eliminated from the factor “attitude toward behaviour”. The indicator “general”, “old clothes” and “eco-bags” were eliminated from the factor “subjective norm”. In addition, new indicators were added in perceived behavioural control factor and VC (intention) factor. Perceived behavioural control factor included “eco-bag – SN6 & PBC2” and “food waste – PBC5” indicators. VC factor included “food waste – ATB3 & VC6).

Table 5-14 Factor Loading from Maximum Likelihood with Varimax Rotation for a Four-Factors Solution for environmental education attitude questions

Item	Factor loading			
	1	2	3	4
Attitude toward behavior				
I never separate my family's waste (ATB2)	-0.596			
I always use eco-bags instead of nylon bags to save the environment (ATB1)	0.511			
Subjective norm				
My family members always save energy (SN5)		0.691		
I do not afraid about solid waste problems (SN2)		-0.565		
It is important for me to follow the rules of society (SN3)		0.462		
Perceived behavioral control				
My family members always use eco-bags to reduce garbage (SN6)			0.679	
I do not like to eat pork from pigs that were fed by food waste (PBC5)			-0.643	
It is easy to carry the eco-bags when I go shopping (PBC2)			0.502	
Verbal commitment (intention)				
I always give food waste to pig farms to reduce waste (ATB3)				0.953
I would be willing to give food waste to pig farms to reduce waste (VC6)				0.402

Note. Loadings < .40 are omitted

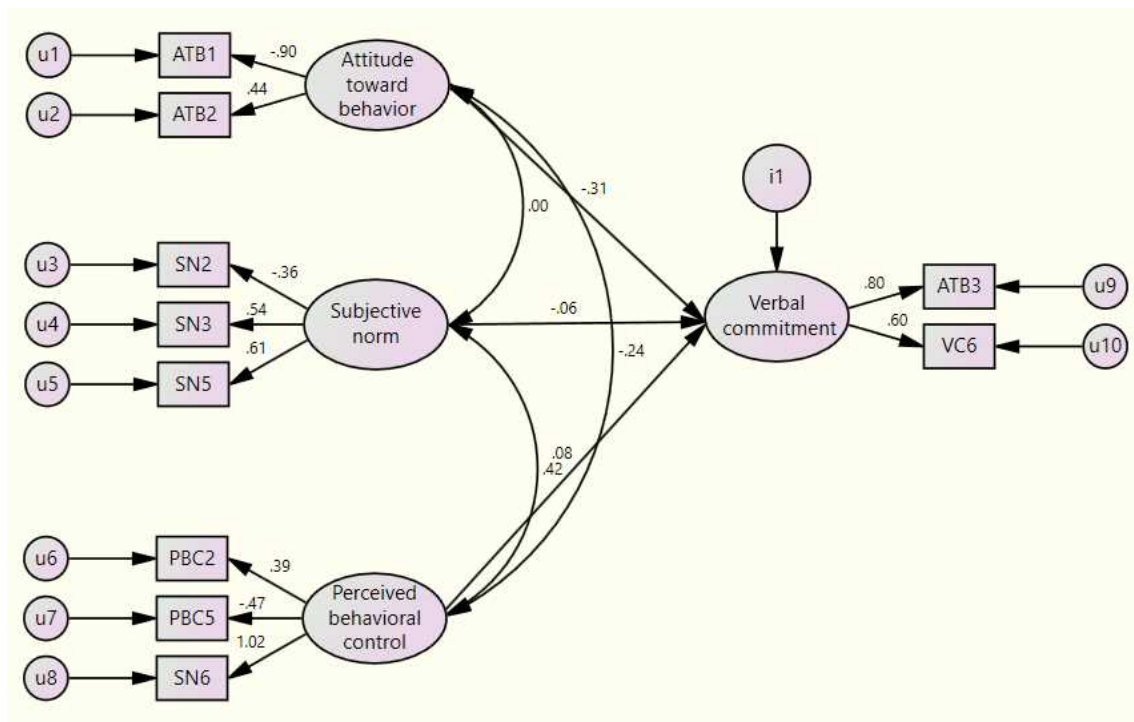


Figure 5-16 standardised results of structural equation model 2

Figure 5-16 presents the SEM depicting the extent to which the model loads onto attitude toward behavior (ATB), subjective norm (SN) and perceived behavioral control (PBC) to VC. The overall modified model displayed a good fit structure with adequate factor loadings that showed in Figure 5-16. From the results at Table 5-13, model 2 was acceptable which χ^2/df (CMIN/df) = 1.602 < 5, RMSEA = 0.062 < 0.8 and CFI = 0.905 > 0.9.

Table 5-15 Standardised model 2 regression weights for VC, ATB, SN and PBC

Parameter			Non-standardized	P
Verbal commitment	←	Attitude toward behavior	-0.499	0.015
Verbal commitment	←	Subjective norm	-0.107	0.699
Verbal commitment	←	Perceived behavioral control	0.068	0.540
ATB2	←	Attitude toward behavior	1.000	
ATB1	←	Attitude toward behavior	-1.826	0.037
SN5	←	Subjective norm	1.000	
SN3	←	Subjective norm	0.637	0.001
SN2	←	Subjective norm	-0.398	0.005
SN6	←	Perceived behavioral control	1.000	
PBC5	←	Perceived behavioral control	-0.498	< 0.001
PBC2	←	Perceived behavioral control	0.415	< 0.001
ATB3	←	Verbal commitment	1.000	
VC6	←	Verbal commitment	0.732	0.016

The new model achieved a greater fit. The VC factor correlated with the ATB factor where $p = 0.015$. In addition, VC did not correlate with perceived behavioural control factor where $p = 0.540$ and subjective norm where $p = 0.699$. This analysis revealed differences between food waste using an eco-bag and separation waste at home. The items of ATB and VC are in Table 5-16.

Table 5-16 Related model items

Item			
Verbal commitment (intention)			
Food waste:	I would be willing to give food waste to pig farms to reduce waste.		VC6
	I always give food waste to pig farms to reduce waste.		ATB3
Attitude toward behavior			
Eco-bag:	I always use eco-bags instead of nylon bags to save the environment.		ATB1
Waste separation:	I never separate my family's waste.		ATB2

5.5.3.3 Model 2 applied to the treatment school of survey 3 (Model 3)

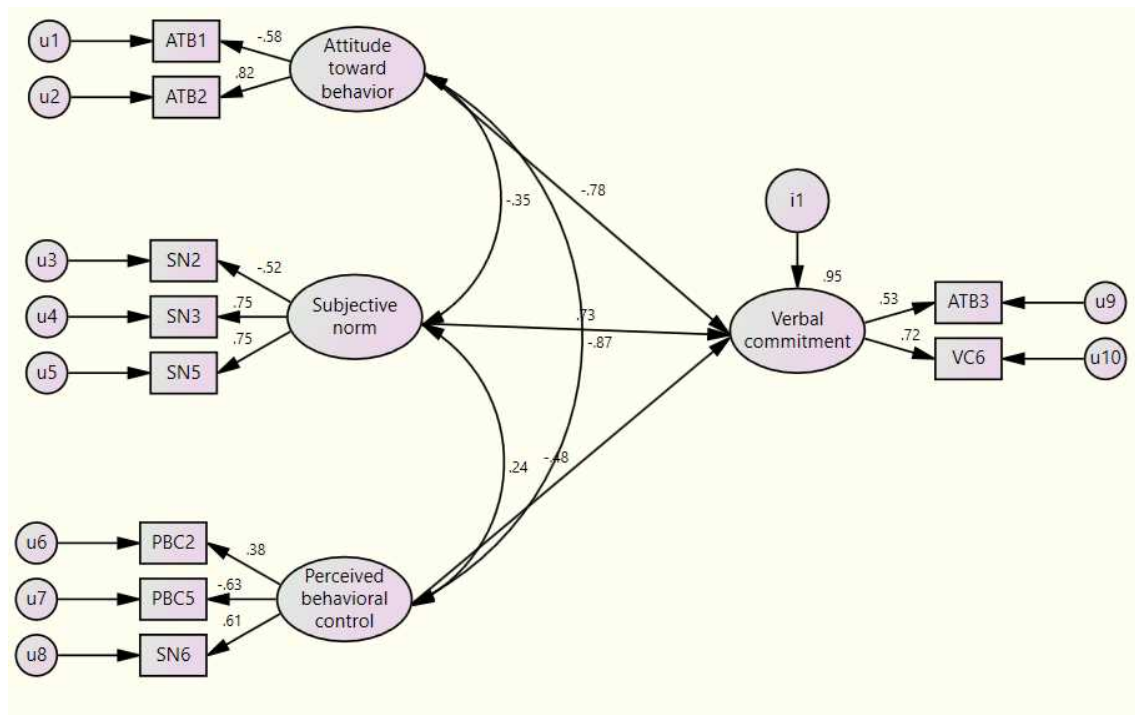


Figure 5-17 Standardised results of structural equation model 3

When we used the chi-square test of model fit for the treatment school at survey 3 following the model that we ran at survey 1. Its value is 51.133 with 29 degrees of freedom, returning a probability value of 0.007, which is smaller than the conventionally used level of 0.05. In addition, the good mode fit of model 3

was $\text{CMIN/df} = 1.330 < 5$ (accepted), but $\text{RMSEA} = 0.103 > 0.08$ and $\text{CFI} = 0.850 < 0.9$ (not accepted). We rejected the null hypothesis that the model fits the data. In survey 3, the model changed in the treatment school.

5.5.3.4 Model 3 modified for the treatment school of survey 3 (Model 4)

Model 3 of the treatment school after EE was not accepted. We ran a factor analysis again for items of treatment school after EE. To determined model 4, exploratory Factor Analysis (Maximum likelihood Estimation) was used to test the relevance of the factors of survey 3 in the treatment school. Maximum likelihood analysis with varimax rotation was conducted to assess the underlying structure for the 24 items of the EE attitude scales. Table 5-17 displays the items and factor loadings for the rotated factor at survey 3 in the treatment school.

Table 5-17 Factor loading in the treatment school at survey 3

Item	Factor loading			
	1	2	3	4
Subjective norm				
Separation waste is easy for me (PBC1)	0.669			
My family members always save energy (SN5)	0.629			
It is important for me to follow the rules of society (SN3)	0.629			
I would be willing to explain to my parents the important of reducing waste (VC8)	0.615			
I would be willing to give food waste to pig farms to reduce waste (VC6)	0.526			
Perceived behavioral control				
I do not like to eat pork from pigs that were fed by food waste (PBC5)		-0.745		
I never separate my family's waste (ATB2)		-0.659		
I would not be willing to save energy by using the air conditioning less (VC2)		-0.580		
My family members always use eco-bags to reduce garbage (SN6)		0.532		
Attitude toward behavior				
I never reuse old clothes in my house (ATB4)			0.639	
My family member always old clothes (SN4)			-0.518	
Verbal commitment (intention)				
I would not be willing to separate my family's waste for recycling (VC5)				0.737
I would be willing to use eco-bags instead of nylon bags to save environment (VC4)				0.549
I not afraid about the effects of pollution on my family (SN1)				0.442
I do not worry about solid waste problems (SN2)				-.727

Note. Loadings < .40 are omitted

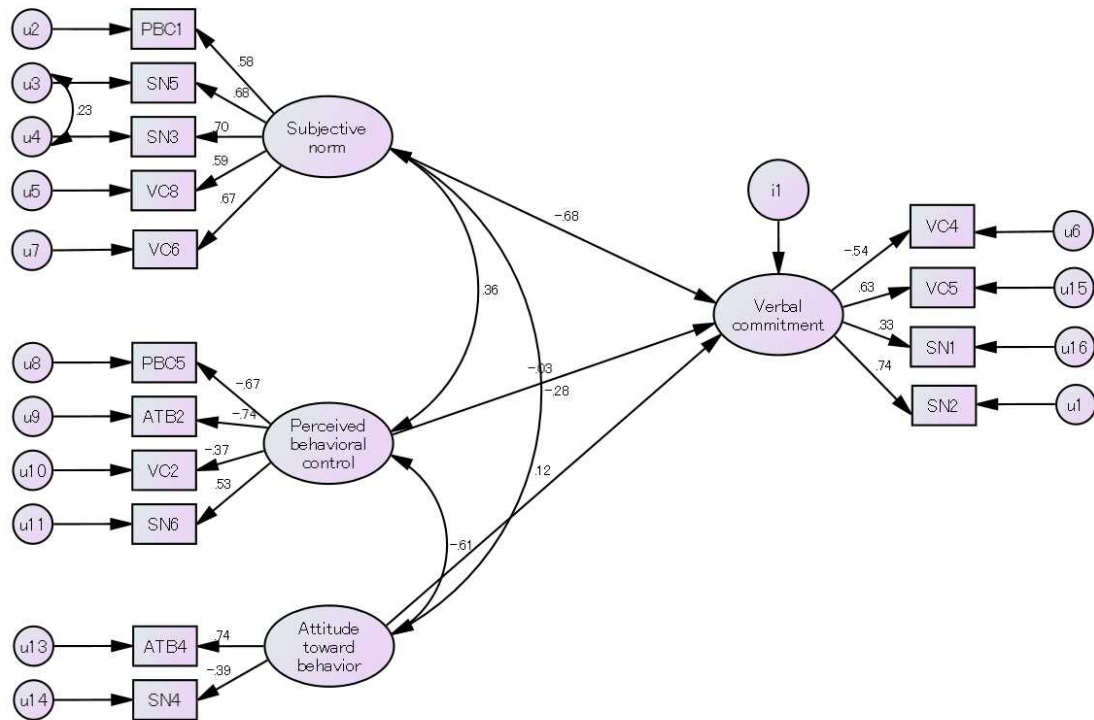


Figure 5-18 standardised results of structural equation model 4

Figure 5-18 above presents the SEM depicting the extent to which the model loads onto ATB, SN and PBC to VC (Intention).

Model 4 was acceptable where χ^2/df (CMIN/df) = 1.148 < 5, RMSEA = 0.045 < 0.8 but CFI = 0.936 > 0.9.

Table 5-18 Standardised regression weights for the VC, ATB, SN and PBC model

4

Parameter			Non-standardized	P
Verbal commitment	←	Subjective norm	-0.925	0.002
Verbal commitment	←	Perceived behavioral control	-0.420	0.900
Verbal commitment	←	Attitude toward behavior	0.097	0.638
VC5	←	Verbal commitment	1.000	
SN1	←	Verbal commitment	0.235	0.021
SN4	←	Attitude toward behavior	-0.470	0.075
ATB4	←	Attitude toward behavior	1.000	
SN6	←	Perceived behavioral control	1.000	
VC2	←	Perceived behavioral control	-0.724	0.016
PBC5	←	Perceived behavioral control	-1.349	< 0.001
VC6	←	Subjective norm	1.000	
VC8	←	Subjective norm	1.093	< 0.001
SN3	←	Subjective norm	0.956	< 0.001
SN5	←	Subjective norm	0.771	< 0.001
PBC1	←	Subjective norm	1.148	< 0.001
ATB2	←	Perceived behavioral control	-1.735	< 0.001
VC4	←	Verbal commitment	-0.689	< 0.001
SN2	←	Verbal commitment	0.911	< 0.001

There is also evidence of adequate correlation of VC and subjective norm where $p = 0.002$, suggesting that these latent variables are related. Despite the established relationship between the intention of children who engage in EE and attitude toward behavior or PBC, the findings in this analysis do not support these relationships.

The study found that before EE, the VC factor was food waste, but after EE, the VC was changed to waste separation, eco-bag and effect of pollution. According our observations and experiences at the school, we found that: Before

EE, food waste was common knowledge that students can get from society, but waste separation was a new concept for students. They gave high answer on food waste at survey 1. After EE, student in the treatment school about waste separation, their correct answers increased.

In addition, we found that at survey 3, the subjective norm coordinated with VC and the attitude toward behavior and VC coordination become weak. We found that waste separation was not common at school. Usually the students separate wastes at home or in a public area. So the subjective norm will be a factor along with VC. As we mentioned in the problem statement, waste separation is a non-formal activity in Vietnam. The student could not practice waste separation, so we did not find any correlation between ATB and VC.

5.5.3.5 Model 5: Model 2 applied to the control school of survey 3

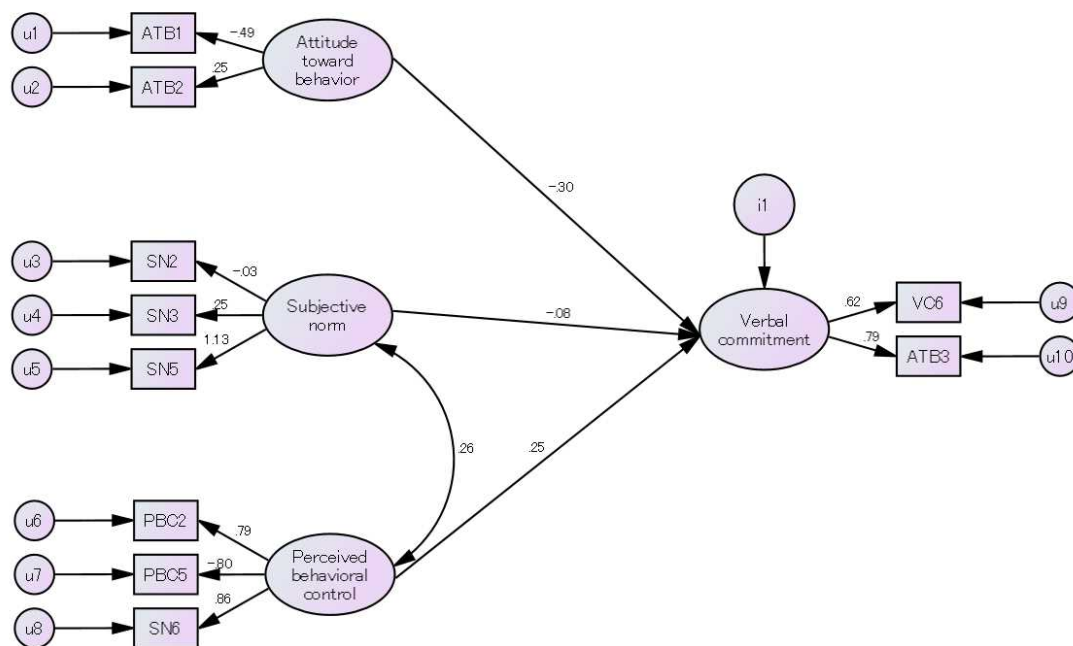


Figure 5-19 Standardised results of structural equation model 5

Model 5 showed in Figure 5-19 is the control school model. Model 5 was acceptable where χ^2/df (CMIN/df) = 1.455 < 5, RMSEA = 0.073 < 0.8 and CFI = 0.901 > 0.9.

The study found that at the control school, the model results were similar to those of survey 1 i.e. before EE. However, the study did not find any correlation between VC and 3 other factors.

Table 5-19 Standardised regression weights for the VC, ATB, SN and PBC for Model 5

Parameter			Non-standardized	P
Verbal commitment	←	Attitude toward behavior	-0.500	0.434
Verbal commitment	←	Subjective norm	-0.069	0.678
Verbal commitment	←	Perceived behavioral control	0.164	0.176
ATB2	←	Attitude toward behavior	1.000	
ATB1	←	Attitude toward behavior	-1.418	0.583
SN5	←	Subjective norm	1.000	
SN3	←	Subjective norm	0.240	0.557
SN2	←	Subjective norm	-0.043	0.766
SN6	←	Perceived behavioral control	1.000	
PBC5	←	Perceived behavioral control	-1.017	< 0.001
PBC2	←	Perceived behavioral control	0.980	< 0.001
ATB3	←	Verbal commitment	1.000	
VC6	←	Verbal commitment	1.319	0.095

5.5.3.6 Effects of EE on student intention to participate in waste management

The study found 2 models that indicated student intention to participate in waste management: (1) before EE and (2) after EE.

(1) Before EE, the study found the model 2 with VC on food waste. The food waste model was used combine data from the treatment and control schools

before the study started the EE activities at the treatment school. After EE activities, just the control school kept the model structure for food waste. But the treatment school changed to a new model referred to as model 4. In addition, we found correlation between factors ATB and VC in model 2.

- (2) After EE, model 4 was for VC on waste separation and effect of pollution. The waste separation and effect of pollution model used data from the treatment school. In model 4, the correlation between VC and ATB was weaker; we found a new correlation between VC and SN.

5.3.5 Comparison between one-time EE and 6-month EE

The study found that students did not pay attention to one-time EE because the grades obtained were not counted towards student's scores. The students did not pay attention during the lecture, but paid attention during the group game. The students were chatting while I gave the EE lecture (Phan Hoang & Kato, 2016). EE activities were done over 6-month (2016 - 2017), so EE activities became a regular lesson in school for students. "No score" was a strong point of our activities, because student can engage in the class without the need of worrying about scores. In addition, we applied a workshop method for teaching EE so student would have group-work time while they participated in the lecture. This enabled students to chat at discussion time and pay attention during lecture time. Students had a good time in the class and wanted to study many new things regarding the environment.

5.4. Limitation

The study reveals certain strategic constraints of EE done by the author. Students could not change to observe collection systems and treatment systems in Da Nang, Vietnam. Because of safety concerns, the rules of the schools, and the length of class, the author could not promote change where students would join activities outside of the school compound. Since Da Nang city does not have an official source separation policy of MSW, students weren't exposed to waste separation in a public area using an educational setting.

5.5 Conclusions

B.2 Development of 6-month workshop course

- From October 2016 to April 2017, the study provided a 6-month EE workshop at a treatment school, Da Nang.
- Students had 4 lessons to understand environmental issues in Da Nang and the greater Vietnam.
- Students joined two practice activities on EE: (1) separation waste game and (2) newspaper activities.

C.1 Development of evaluation method

- Use treatment-control design to collect data and measure the impact of EE to student.
- Observed student newspaper pictures and collected data from student presentation to made newspaper analysis.
- Made a model to analyse student intention based upon theory of planned behaviour.

C.4 Evaluation of 6-month education

- Impacts on student knowledge: Before EE, the study had a low impression on solid waste management. After EE, the students in the treatment school increased their knowledge on solid waste management.
- Compare student knowledge in treatment - control design. After the 6-month EE activities, student's knowledge in the treatment school increased by 64% for 3Rs and 90% for reason for recycling. Student knowledge in the control school did not change and decreased when compared with survey 1 by 9% for 3Rs, and by 9% for reason for recycling.
- Students showed their appreciation for the EE workshop in their newspaper. Student drew many elements related with solid waste on their newspaper. The majority of the students drew rubbish (100%) and dustbin (62.5%), 75% included people, 50% included trees and 43.5% included fruits and parks.

- We found that depending on the types of knowledge on solid waste management, a suitable teaching method needed to be considered. For new knowledge on solid waste management, lectures are required to efficiently improve knowledge levels among students. For basic knowledge that students have already, the practice activities have more impact on student knowledge than lectures do. The teaching method is required to have both lecture and practice components to adopt missing knowledge.
- The study used SEM to measure the intention model. Before EE, we found a relationship between intention and food waste (attitude toward behavior) at survey 1. After EE, the study found students' intention changed to waste separation, pollution and eco-bag.

Chapter 6 IMPACT OF ENVIRONMENTAL EDUCATION AFTER 14 MONTHS

6.1 Introduction

C.5 Evaluating the effect of EE after 14 months. This chapter aims to measure the one-year effects on 4th grade students who took advantage of the 6-month EE program in SMW presented in chapter 5. The experience satisfied the ingredients of EE discussed in the literature we have cited: the students had a variety of experiences and acquired SMW knowledge and an understanding of their roles to protect the environment. In addition, this study positively impacted the long-term indoor EE for elementary students as their behavior changed after EE.

6.2 Methodology

6.2.1 Education procedure and survey

A questionnaire survey was prepared to evaluate student knowledge and intention after 14 months of EE. Figure 6-1 shows the structure of this questionnaire survey.

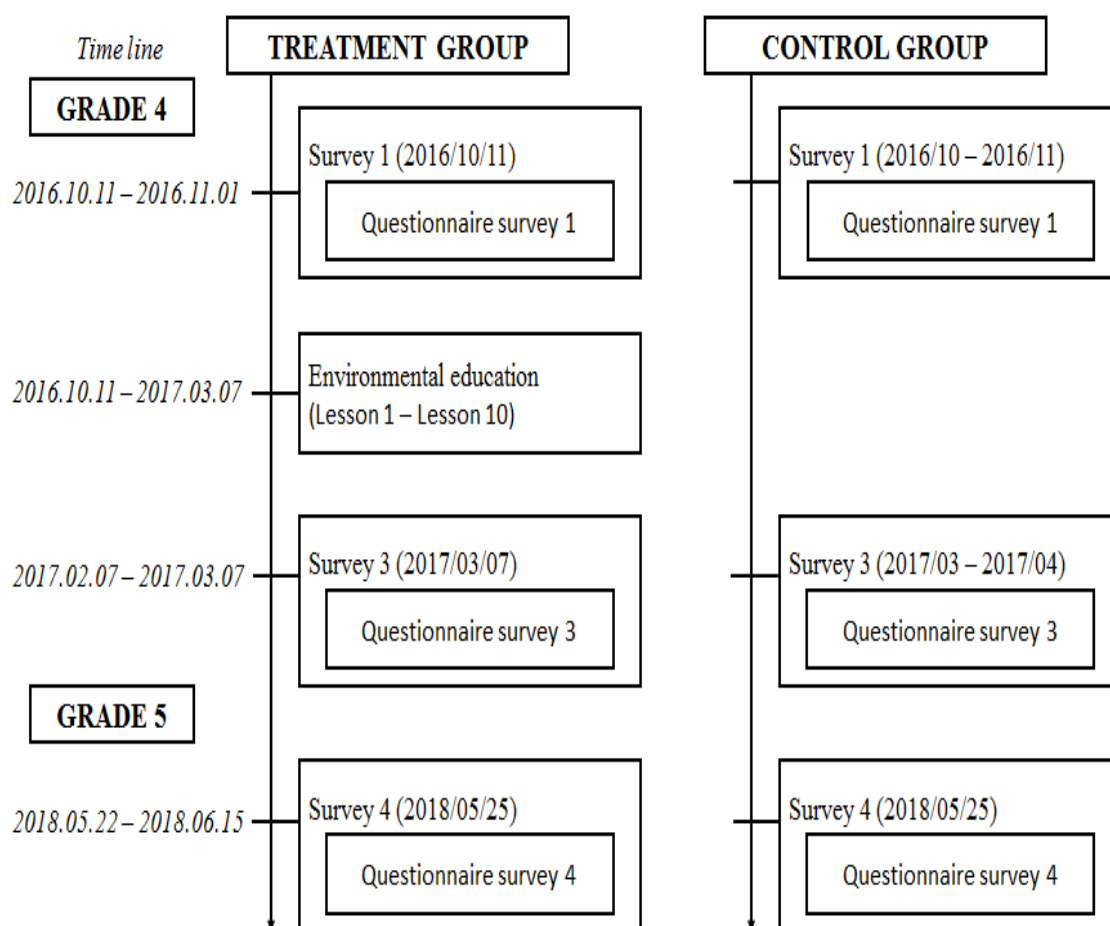


Figure 6-1 Structure follow up questionnaire survey

The first 14 questions were similar to those in the survey 3 to understand students' knowledge after one year. We picked 6 questions from survey 3 to test EE after one year (2017 – 2018).

Table 6-1 shows questions 9 to 14 from the questionnaire. The underlined sentences are the correct answers to the questions. These questions focused on our EE conducted in the treatment school. We wanted to evaluate students' knowledge after 1 year. According to the results, we can understand the weak and strong points of our EE and from that we improve the EE program for elementary students in Vietnam and possibly by extension, Southeast Asia.

Table 6-1 Shows question 9 to 14

Question 9 <i>Landfill</i>	In Da Nang where does most of the waste go after it is collected by waste trucks (a) To an open dump where it is buried (b) It is dumped into the ocean (c) It is recycled to make plastic (d) <u>To Khanh Son sanitary landfill</u> (e) To farmers who use it as fertilizer
Question 10 <i>Eco-bags</i>	What is an eco-bag? (a) A nylon bag that can be used only once (b) A paper bag that can be used only once (c) A cloth bag that can be used only once (d) A plastic bag that can be used only once (e) <u>A plastic bag or cloth bag that can be reused many times</u>
Question 11 <i>3Rs</i>	What does 3Rs mean? (a) <u>Recycle, reuse and reduce waste</u> (b) Throw waste in the rubbish bin (c) Recycle, reuse and separation of waste (d) Reuse and reduce waste (e) Protect the environment
Question 12 <i>Recycle</i>	Why do we need to recycle? (a) <u>To reduce the amount of waste that goes to a landfill</u> (b) To earn money (c) For fun (d) For school donations (e) To reduce space
Question 13 <i>Using eco-bags</i>	The main reason for using eco-bags is: (a) To recycle waste (b) For their ease of use (c) <u>To reduce the amount of nylon-bags, protect environment</u> (d) For fashion (e) To save money when we go shopping
Question 14 <i>Recycle clothes</i>	What should you NOT do when you grow out of clothes? (a) <u>Throw them out and buy new clothes</u> (b) Pass them on to a sibling or friend (c) Pass them on to a younger family member (d) Donate them to a charity (e) Use them to clean your house

6.2.2 Follow-up survey at 14 months

We conducted the survey and short discussion at the end of the fall semester of 2018, a year after environmental activities in 2017, to explore the student recollection of the environmental activities. We visited classes after students completed their final examinations in school and requested the students to fill out the questionnaire survey for 20 minutes. Final we had 10 minutes to discuss with students about contents of environmental activities. When 4th grade students entered 5th grade, some students changed their class, so this questionnaire survey engaged 63 students who had participated in the program previously. Initial contact with the school included an explanation for contacting them; we scheduled the survey a day later and we did not let the students know about the survey beforehand.

In 2018 we again surveyed 4 classes of 5th grade students (September 2017 4th grade students who became 5th grade students). We examined the effectiveness of EE that we provide from October 2016 to March 2017.

Table 6-2 Number of schools and students that joined surveys 3 and 4

	Survey 3	Survey 4
School	2	2
Student	152	133
Number of questions	41	22
Survey time	30 minutes	20 minutes

Table 6-2 shows the number of questions in the questionnaire survey in 2017 and 2018. We used the first 14 questions from the 2017 questionnaire (survey 3) to check the students' knowledge after one year. In addition, questions 16 to 21 were 5 new questions to check student behavior according EE.

Survey 4 contained four sections. The first and third sections consisted of closed questions. The second and fourth sections had open-ended questions

designed to evaluate student memories about EE lessons and environmental activities in elementary school. The four sections were as follows:

1. The initial 14 were similar questions to those in 2017 to understand students' knowledge after one year.
2. Question 15 followed a statement: "Could you please write down what you remember of the environmental activities that you participated in last year?" From this question, we can assess a student's memory about EE that they received in 2017. With this question, we want to check the student's interest in EE.
3. Questions 16 to 21 asked students about their daily life behavior. We used a 5 scale ranking to evaluate student behavior in their daily life.

Questions	Always	Very often	Sometimes	Rarely	never
16. Did you save water when you take a bathe?					
17. Did you turn off light when you go out to save energy?					
18. Did you separate waste in your home?					
19. Did you carry eco-bags when you go shopping?					
20. Did you or your family give food waste to pig farms?					
21. Did you explain your parents about the importance of reducing waste?					

Figure 6-2 Shows question 16 to question 21

In the first section of the questionnaire survey, we checked student knowledge after one year. In this section, we wanted to focus on student behaviour according their knowledge. In survey 3, because of some limitations in the study, we could not check student behaviour. In survey 4, we wanted to evaluate student behaviour after they studied EE in 2017. These questions are related to knowledge that students received in EE from the author and school lessons.

4. Question 22 was “Could you please write down environmental activities that you engaged in the after you moved from 4th to 5th grade?” Sometimes, the school or Vietnamese society can provide some environmental activities for students. We wanted to carefully check factors that had a lasting impact on students after one year.

The questionnaire was group administered in each class of the treatment group by the authors as the teachers were not allowed to help the students. In the control school, the questionnaire was collected by teachers. When we conducted the questionnaire survey 4 in May 2018, it was the final week of the school year and some students were absent from school. When students entered 5th grade, some had changed class for unspecified reasons. As a result the numbers of students in the survey 4 were less.

6.2.3 Environmental education control school

On May 2018, we visited the control school to invite the school to join our survey in 2018, and collected some data from private EE at school. We got some information about private environmental activities in the control school. In 2017, all students had EE lessons together for 15 minutes from their schoolteacher. Every Monday in elementary school, the entire school gathers for assembly in the schoolyard and receive information about their study plan or activities plan for the new week. In 2017, students in the control school changed to join environmental activities from the school. In this class, the teacher talked about waste types that can decompose, can't decompose, and can never decompose.

6.3 Research hypothesis

The following hypotheses were formulated for testing:

- Formulated for testing student knowledge:

Environmentally aware and empowered youths are potentially the greatest agent of change for the long term protection and stewardship of the environment

(Erhabor & Don, 2016). Research also indicated the positive correlation, i.e. students with higher performance on environmental knowledge presented more active value to environmental problems (Kaffashi, Yacob, Clark, Radam , & Mamat, 2015). EE will increase knowledge, potentially leading to changes in attitudes and people's interaction with their environment (Kaiser, Oerke, & Bogner, 2007) (Ploeg, Cauilan-Cureg, Weerd, & Groot, 2011). Through the evaluation of previous EE for elementary students at school, the following hypotheses are therefore proposed in this study.

Hypothesis 1 (**H1**) - there will be a significant difference in the level of student environmental knowledge after one year in the treatment school and the control school.

Hypothesis 2 (**H2**) - there will be no significant difference between boys and girls in their level of environmental knowledge in the treatment school.

Hypothesis 3 (**H3**) – there will be significant difference between students who chose the right answers in the surveys 3 and 4 from the treatment school. We expect the knowledge levels of the students to decrease after one year.

Here, students who had equal to or more than 3 right answers shown in Figure 6-2 were designated as good scores.

- Formulated for testing student behavior

Environmental quality strongly depends on human behavior patterns (Steg & Vlek, 2009). The theory of EE is that increasing knowledge will improve attitudes towards the environment (Rakotomamonjy, Jones, Razafimanahaka, Ramamonjisoa, & Williams, 2014). Most EE course plans accept the “knowledge-attitude-behavior” theory, i.e. believing that an increase in environmental knowledge will change personal attitudes toward the environment and further generate responsible environmental behaviors (Liu & Guo, 2018). There is a great deal of research outlining interventions to increase pro-

environmental behavior, many of which are aimed at elementary school students. Through the evaluation of previous EE for elementary students in school, the following hypotheses are therefore proposed in this study.

Hypothesis 4 (**H4**) - we expect that student behavior regarding solid waste management in the treatment school will be more influenced than that of the control school.

Hypothesis 5 (**H5**) - students will adopt behaviors of saving water and saving energy from the savings section of the education. Because saving water and saving energy were not including in our EE, this knowledge is provided in their elementary school guide book.

The study additionally examined answers that change across surveys 1, 3 and 4. We wanted to estimate student behavior according to the changing of answers through surveys 1 before EE, survey 3 after EE and survey 4 fourteen months after EE.

6.4 Results

6.4.1 Hypothesis 1

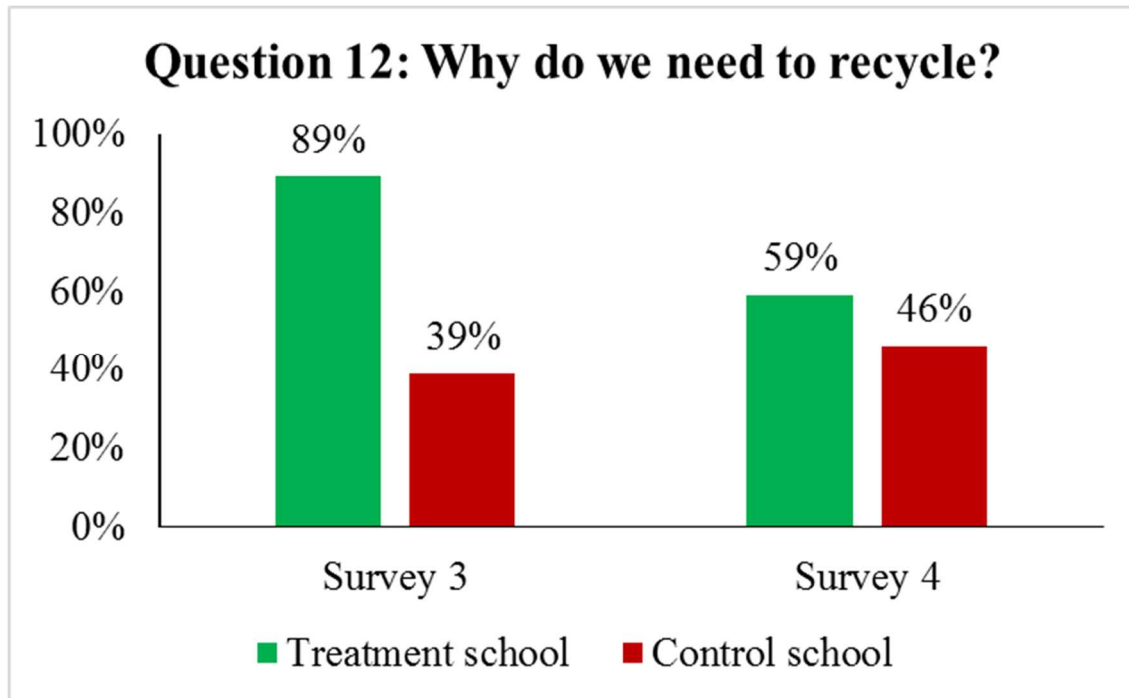


Figure 6-3 Comparison between treatment and control schools

We found that in the treatment school, student knowledge decreased for question 12 “Why do we need to recycle?” In survey 3 there was a significant difference between treatment and control schools in question 12 where $P = 0.000$, but there were no significant differences in survey 4 where $P = 0.165$. We observed that in Vietnam, waste separation or waste recycling is not common, and not many people care nor think about it. Therefore, students do not understand why they need to recycle waste in their daily lives. But in 2017, only the students who completed EE training knew how to answer this question.

Table 6-3 Comparison of students' knowledge after one year

Question	% right answer survey 3		% right answer survey 4	
	Treatment school	Control school	Treatment school	Control school
Question 9 <i>Landfill</i>	71%	34%	89%	14%
	$X^2(1) = 18.324, P = 0.000$		$X^2(1) = 73.822, P = 0.000$	
Question 10 <i>Eco-bags</i>	62%	44%	86%	43%
	$X^2(1) = 4.129, P = 0.056$		$X^2(1) = 26.173, P = 0.000$	
Question 11 <i>3Rs</i>	67%	49%	67%	14%
	$X^2(1) = 4.433, P = 0.038$		$X^2(1) = 38.208, P = 0.000$	
Question 12 <i>Recycle</i>	89%	39%	59%	46%
	$X^2(1) = 35.783, P = 0.000$		$X^2(1) = 2.250, P = 0.165$	
Question 13 <i>Using eco-bags</i>	70%	46%	90%	61%
	$X^2(1) = 7.881, P = 0.005$		$X^2(1) = 14.997, P = 0.000$	
Question 14 <i>Recycle clothes</i>	43%	17%	48%	30%
	$X^2(1) = , 10.579P = 0.002$		$X^2(1) = 4.354, P = 0.049$	

We used chi-square test with an alpha level of 0.05 (5%) to test differences between student answers in the surveys 3 and 4. Table 6-3 shows students' knowledge after one year in the treatment and control schools. In the table, there were significant differences in the level of student environmental knowledge after one year in the treatment school compared to the control school (H1). In 2017, we found that there were statistically significant differences between treatment and control schools in 5 out of 6 questions. The results show that students in the treatment school had more correct answers than those in the control school. EE had a positive impact on students in the treatment school.

In addition, for 5 out of 6 knowledge questions in 2018, students in the treatment school still had better results than those in the control school. The EE from the author had a positive impact that the previous year's.

In 2017, after EE in the treatment school, we gave students a notebook with a cover including information that we imparted on the students. We observed that some students still used our notebook in 2018. The study found that EE should be promoted not only in theory but in practice to have a positive and lasting effect on students. The study found that for question 12, there were no statistically significant differences between treatment and control schools. Students in the treatment school had a higher environment knowledge level than those in the control school. EE done by the author did affect students in the treatment school.

We found that there were significant differences in the levels of students environmental knowledge after one year between treatment and control schools, except for question 12, where $P = 0.165$. But overall, the students' knowledge in the treatment school increased after one year (H1).

6.4.2 Hypothesis 2

Table 6-4 Comparison of student knowledge in the treatment school

Questions	Gender	
	Boy N = 38	Girl N = 25
Question 9 – Landfill	$X^2(1) = 0.330, P = 1.000$	
Question 10 – Eco-bags	$X^2(1) = 1.337, P = 0.298$	
Question 11 – 3Rs	$X^2(1) = 8.488, P = 0.060$	
Question 12 – Recycle	$X^2(1) = 1.469, P = 0.298$	
Question 13 – Using eco-bags	$X^2(1) = 4.363, P = 0.730$	
Question 14 – Recycle clothes	$X^2(1) = 1.167, P = 0.313$	

Table 6-4 shows that there were no statistically significant differences between genders, in the treatment school (H2). This means that EE given to students had an equal effect on both genders. In addition, we found that the students in the treatment school had gathered same level of knowledge after our EE.

The study shows there were no significant difference between boys and girls in their level of environmental knowledge in the treatment school (H2). EE had the same affected on both genders.

6.4.3 Hypothesis 3

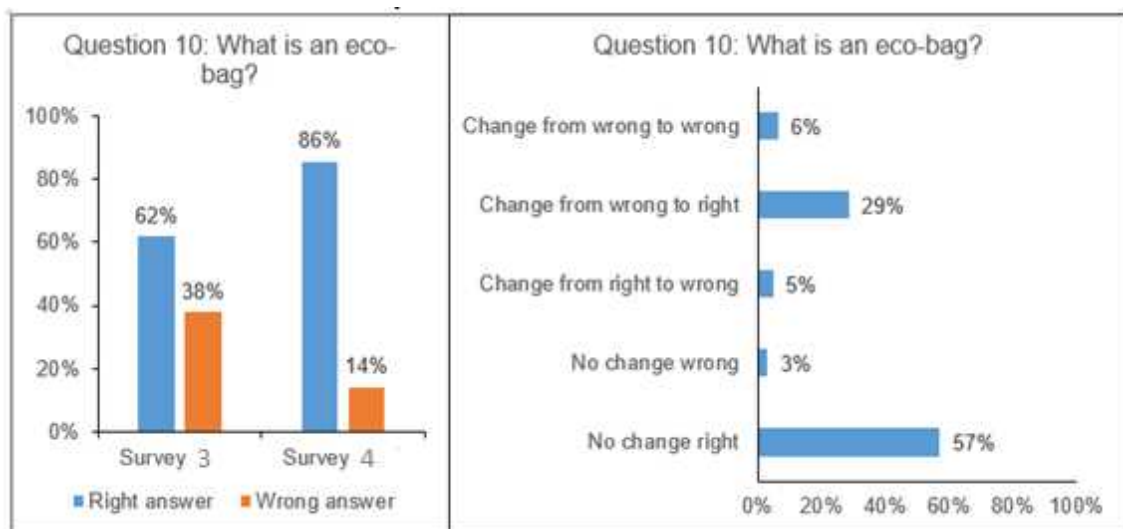


Figure 6-4 Difference of student answer in survey 3 and 4

We found significant differences in students' knowledge between surveys 3 and 4 in the treatment school: question 9 - $P = 0.01$, question 10 - $P = 0.001$, question 12 - $P = 0.000$ and question 13 - $P = 0.002$.

Figure 6-4 shows that for survey 4 in 2018, a higher percentage of students gave the right answer than in 2017 for question 10. Here, 57% of the students did not change to the right answer and 29% of the student changed from wrong answer to right answer.

Student's names were recorded in both surveys and served as individual IDs for each student to evaluate their scores from the two different years in which surveys were conducted. To evaluate difference between students' knowledge, the study used the same 6 questions from those between questions 9 to 14. The student, who had equal to or more than 3 right answers, would get a good score.

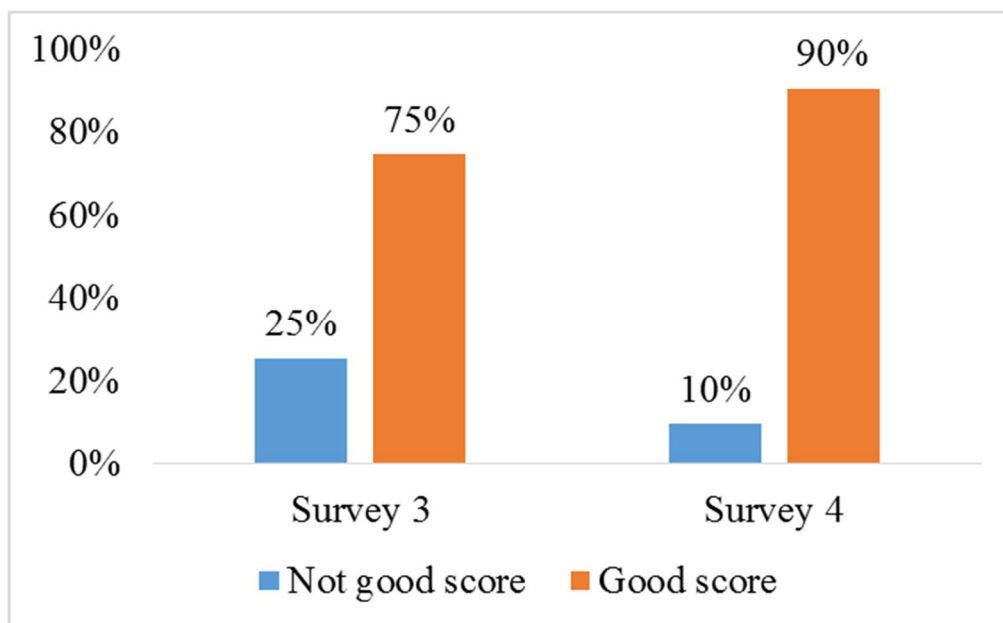


Figure 6-5 Difference between students who had good scores between survey 3 and 4 - treatment school

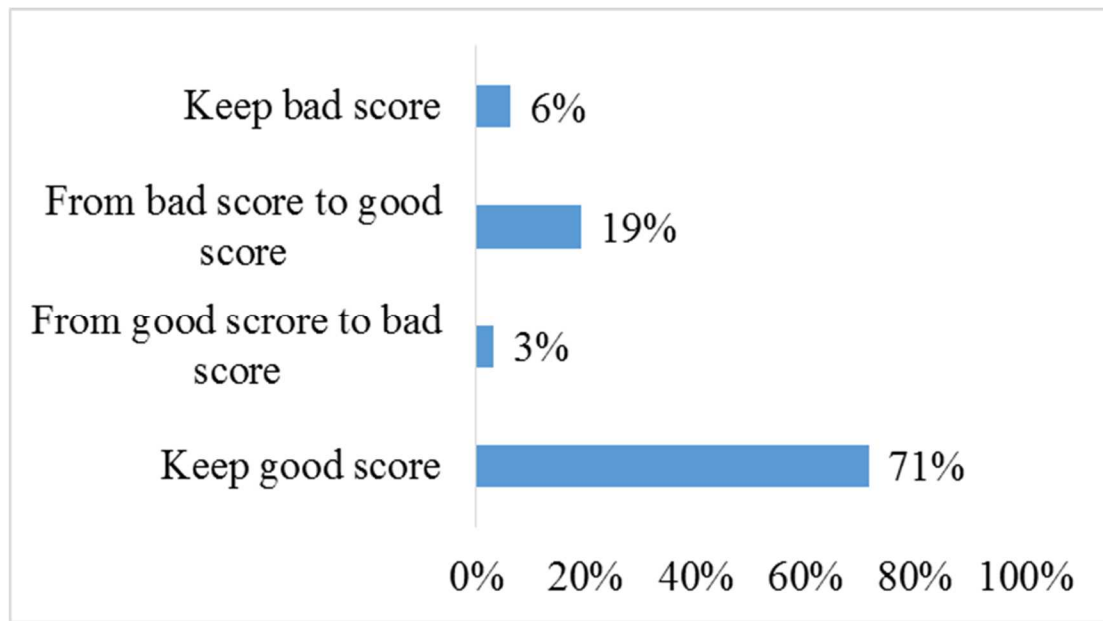


Figure 6-6 Change in students who had a good score between surveys 3 and 4 - treatment school

Figure 6-6 shows that students with correct answers increased in survey 4 where just 3% changed from a good score to a bad score. According to Figure 6-6, 71% of the students maintained a good score after 1 year and 19% changed from a bad score to a good score. The study found there were significant differences between students who had a good score in survey 3 and good results from survey 4 in the treatment school by using paired T-Test with $P = 0.007 < 0.05$.

6.4.4 Hypothesis 4 and 5

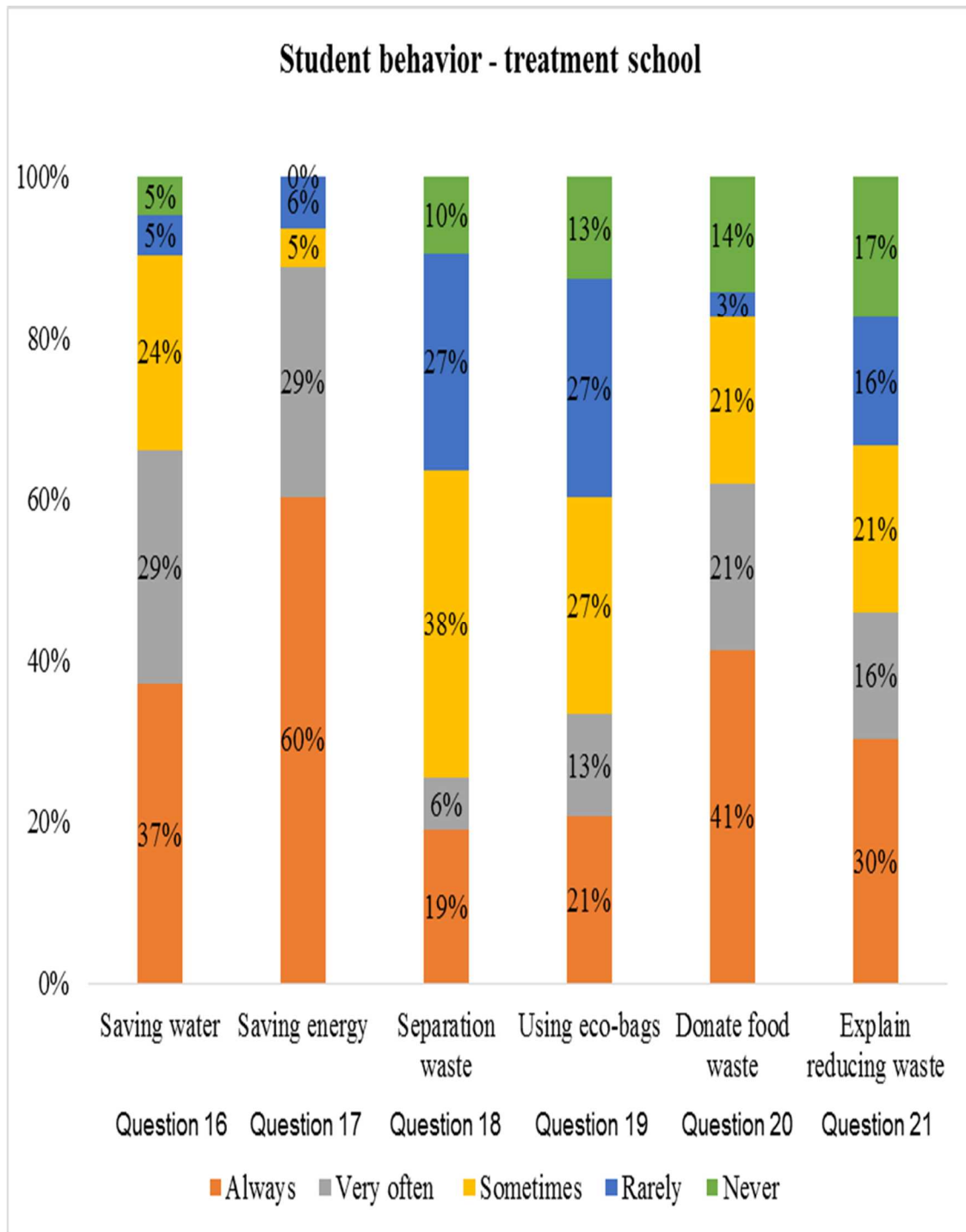


Figure 6-7 Student's daily life behaviour - treatment school

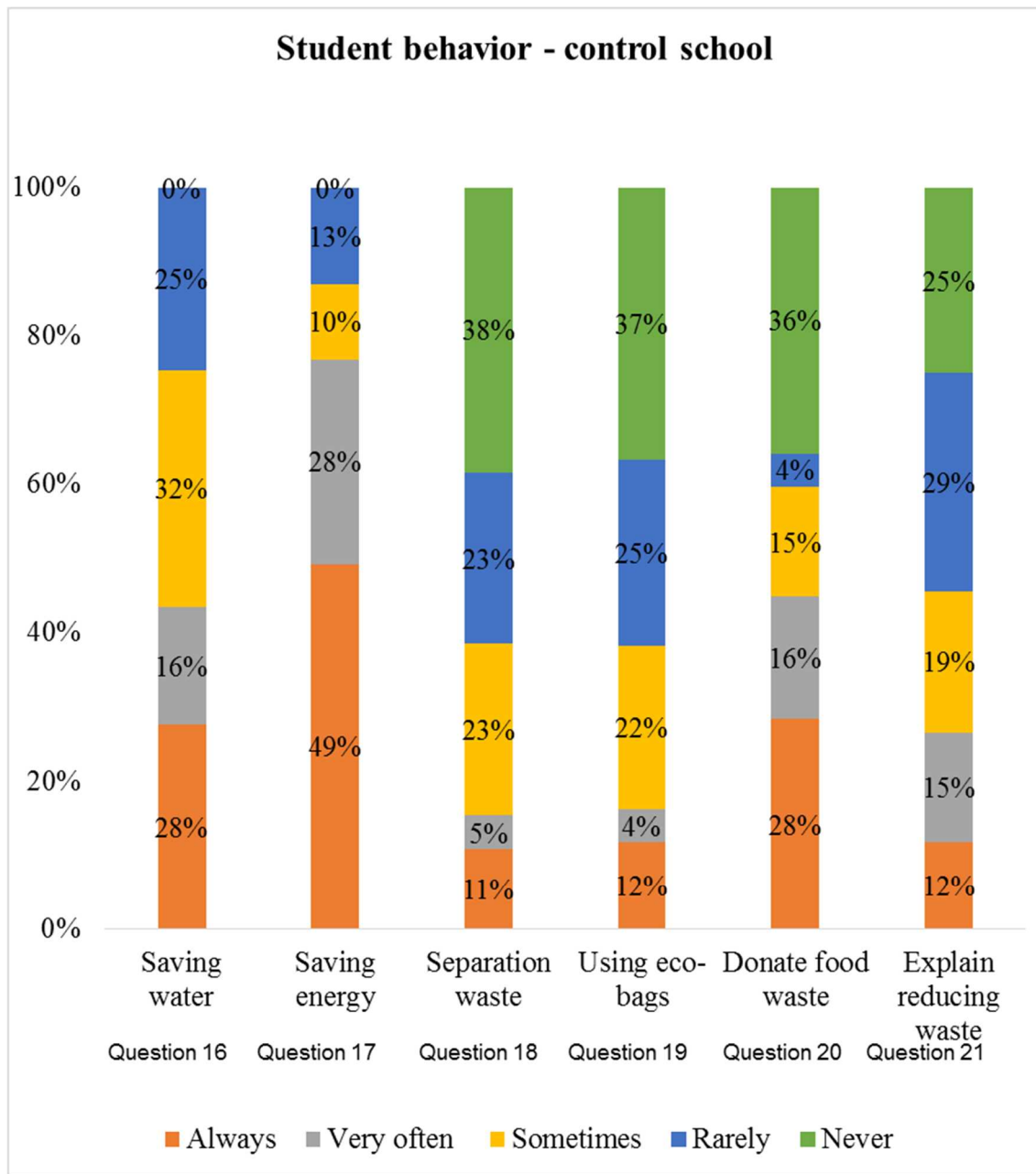


Figure 6-8 Student's daily life behaviour - control school

To understand student's behavior, the study used Mann-Whitney U Test to check the difference between treatment and control schools. In questions 16, 18, 19, 20 and 21; we found the significance level was lower than 0.05. This indicates that student behavior in the treatment school was more influenced than those of the control school supporting H4 and H5.

We also found that student behavior in the treatment school was more influenced than in the control school from the solid waste management activities. Questions 18, 19, 20 and 21 magnify a big difference between treatment and control schools (H4). In the control school the percentage of students who answered “never” become higher than those in the treatment school. Students who said that they “never” separate waste at their house was 36%, students who said that they “never” carry an eco-bag when they go shopping was 36%, students who said that their family “never” give food waste to pig farms was 34%, and students who said they “never” explain about the importance of reducing waste to their parents was 24%.

In the treatment school we can see that the percentage of students who answered “never” was very low at fewer than 18%. Here, 38% said that they “sometimes” separate waste in their home, 27% “sometimes” carry eco-bags when they go shopping, 41% said that their family “always” give food waste to pig farms, and 30 % said that they “always” explain about the importance of reducing waste to their parents.

In the introduction section, we shared information about private EE at the control school. We conducted EE at the treatment school only. EE was done in the control school using different content to our EE. In Figure 6-10; we can see that all answers from the control school’s student were “I don’t know – 37%”; “I couldn’t remember – 19%”; just 18% of the students wrote about how waste can be decomposed, waste can't be decomposed and waste that can never decompose.

In addition, in the treatment school 35% of the students wrote something related to knowledge about EE, where: 9% wrote about organic and non-organic waste; 6% wrote about organic waste, non-organic waste and recycle waste; 3% said that they remember the 3Rs concept; and 6% wrote about recycling waste.

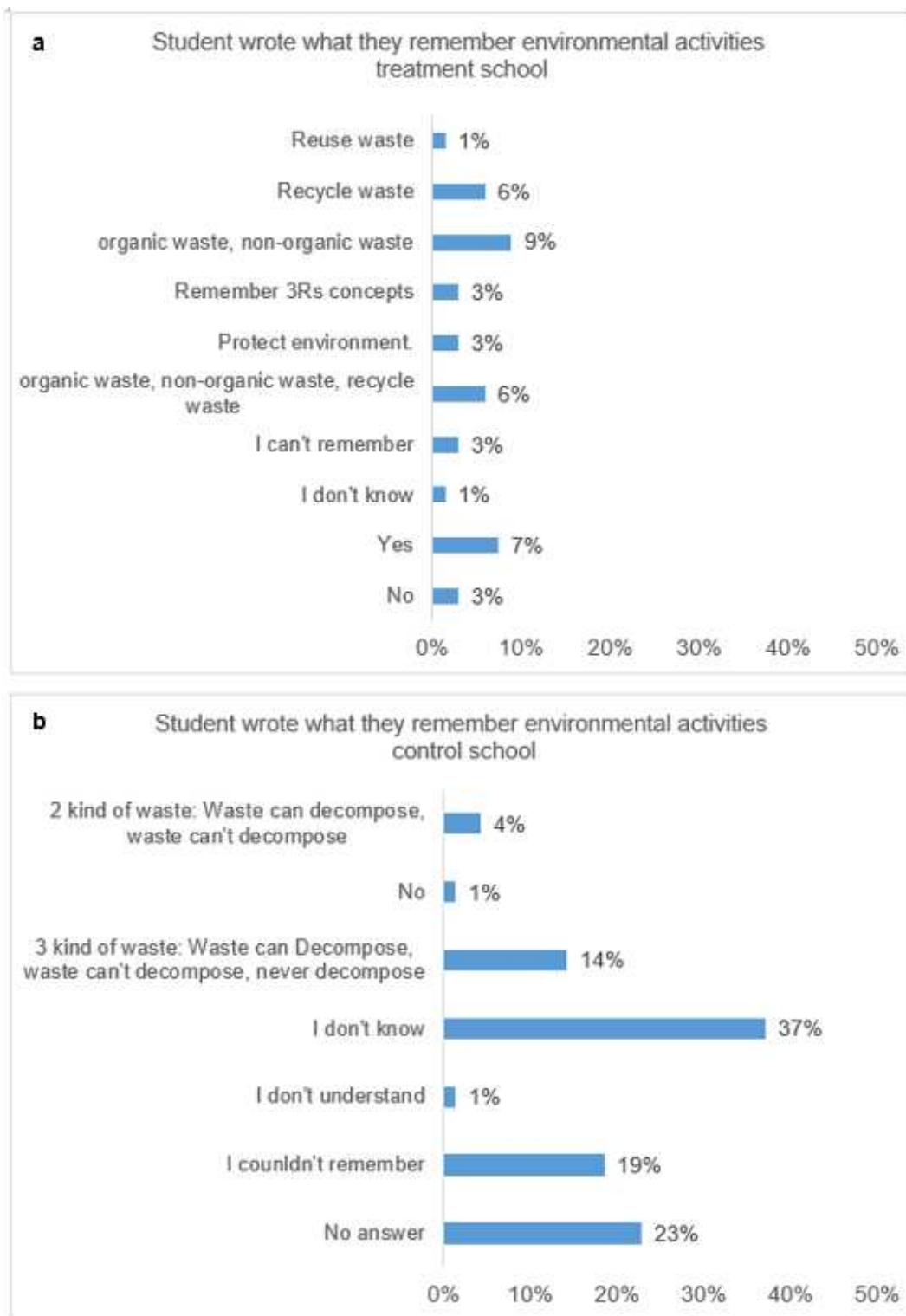


Figure 6-9 Student's memory about EE

As we mentioned before, saving water and saving energy can save money too, so many parents always teach their children this at home. This was

reinforced with water saving education in 4th, and energy saving education in the 5th grade. We found no significant difference between the treatment and control schools in saving energy. However, we found a significant difference between treatment and control schools in saving water (H5).

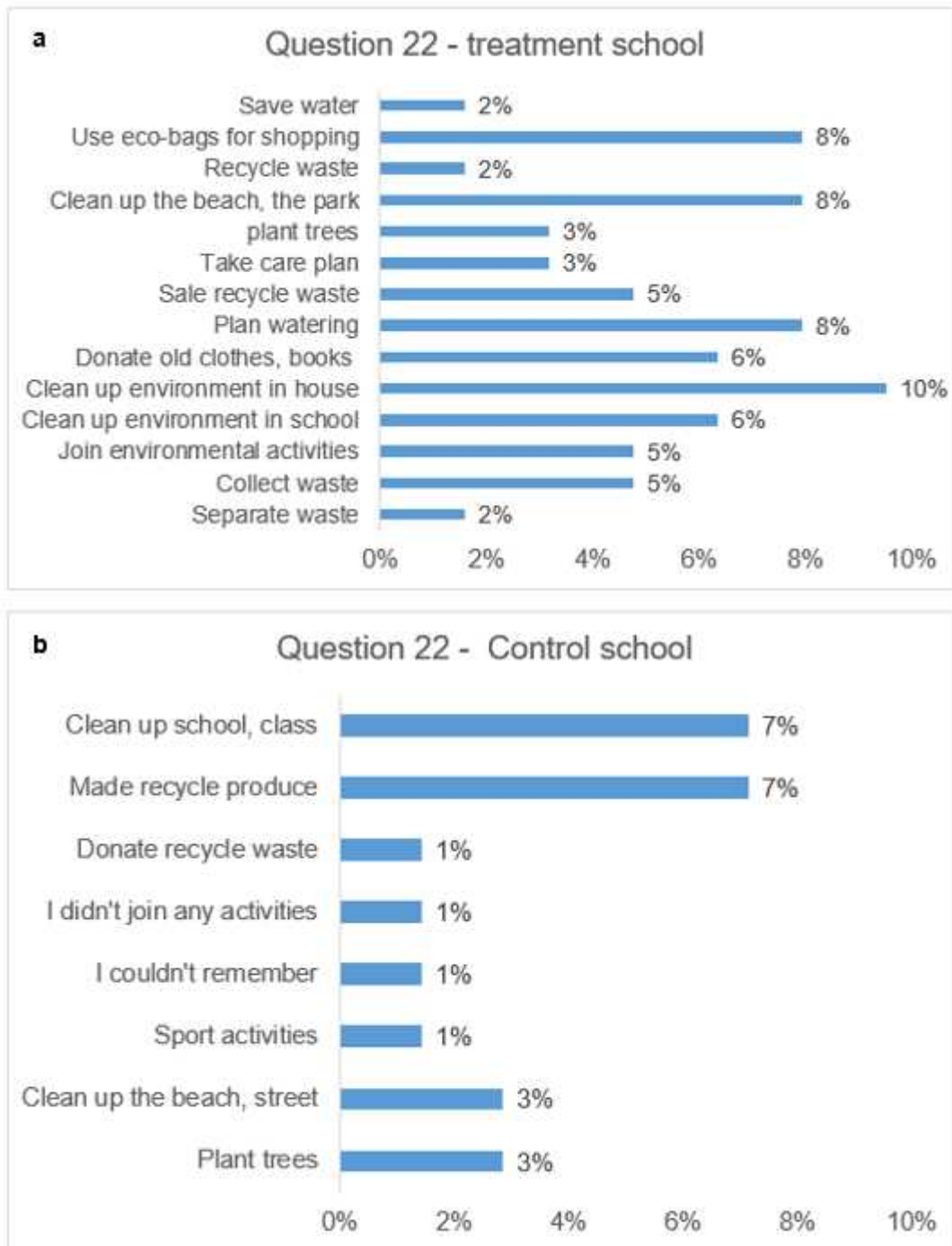


Figure 6-10 Environmental activities that students from 2017 to 2018

We found that students in the treatment school joined more activities after EE than those in the control school. In question 22 we asked students about environmental activities that they joined in 2017 and 2018. From Figure 6-10 we found that students in the treatment school joined water saving activities.

We can deduce from Figure 6-10 that the treatment school's students joined many activities provided by the school, such as: clean up school or class, make recycle produce, donate old books or old clothes; some activities from family, such as: watering plants, planting trees, clean up the house, park or beach. In the treatment school, some students had activities that were related to solid waste management, such as: 8% used eco-bags when shopping, 2% tried to separate waste and 6% said that they donated their old clothes and old books to school.

The study found that students will be more active in environmental activities after they join EE.

The study found that EE affected students equally. From these open-ended questions, the study revealed that EE is fundamental, allowing students to increase their environmental knowledge and environmental behavior.

EE was promoted to change student behavior and we believe that our environmental education had a positive impact and generated good results for 4th grade students in Da Nang, Vietnam.

The study found that student knowledge in the treatment school was increased after one-year's activities. We observed two things: 1) at the end of EE in 2017 we provided a notebook with a cover containing knowledge about solid waste management that we taught students in 6 lessons at the treatment school. In May 2018, we found that some student still used that notebook. 2) We provided two lessons for students to make a newspaper to introduce and promote information about the environment by themselves. After making a newspaper, all

students needed to present their newspaper ideas and its contents. These activities made students think more about what they studied in our class and what they think about the environmental situation around them.

Environmental knowledge about the reason “Why we need to recycle?” found no significant difference between the treatment and control schools. We observed that waste separation did not exist in Vietnam, and waste recycling was not a common activity or concept in school and/or society. For this reason students did not care and were confused about waste recycling.

From results of the Mann-Whitney U test we found that in terms of environmental behavior the treatment school’s students were more influenced by practiced behavior than control school’s students. We found that for water saving, student behavior at the treatment school was higher than that at the control school. In the treatment school, we had two lessons for student to draw and talk about their environmental ideas. These activities made students think more about their environment.

6.4.5 Measurements student performance through their answers selected at surveys 1, 3 and 4

Environmentally aware and empowered youths are potentially the greatest agent of change for the long term protection and stewardship of the environment (Erhabor & Don, 2016). Research indicated the positive correlation, i.e. students with higher performance on environmental knowledge presented more active value to environmental problems (Kaffashi, Yacob, Clark, Radam , & Mamat, 2015). Environmental education will increase knowledge, potentially leading to changes in attitudes and people’s interaction with their environment (Kaiser, Oerke, & Bogner, 2007) (Ploeg, Cauilan-Cureg, Weerd, & Groot, 2011).

Through the evaluation of previous environmental education for elementary students at school, the following hypotheses are therefore proposed in this section.

Hypothesis 1A (H1A) – There will be significant difference between students who chose the right answers in the surveys 1, 3 and 4 in the treatment school. We expect the knowledge levels of the students to increase after environmental education and decrease after 14 months.

Hypothesis 2A (H2A) – It is difficult for students to change their answer after environmental education, if the answers were related with school rules or their daily-life behavior.

Hypothesis 3A (H3A) - It is difficult for students to change their answer after environmental education, if they gave “no answer” at survey 1.

In addition, this section is estimating the students intention and behavior according to their answers between treatment and control schools. We used the same questions at surveys 1, 3 and 4 to estimate their answers. The study created and applied the answers that were related with the situation in Vietnam, especial Da Nang city. For example, food waste used to feed pigs is a treatment system in many cities in Vietnam. This system is still employed in Hoa Vang district in Da Nang city. The study had “it is dumped into ocean” as an answer in question 33 – Da Nang landfill, because Da Nang located near the ocean. This answer was included to understand the student’s lifestyle behaviour. The answers can be select depending on the situation in the area where the study is applied.

First, we show the results regarding H1A

We found significant differences in students’ knowledge between the 2017 and 2018 surveys in the treatment school: question 9 - $P = 0.01$, question 10 - $P = 0.001$, question 12 - $P = 0.000$ and question 13 - $P = 0.002$.

Table 6-5 Student right answers at surveys 1, 3 and 4

Questions	Survey 1	Survey 3	Survey 4
Question 9	30%	70%	90%
	P (-5.402) = 0.000	P (-3.408) = 0.001	
Question 10	41%	59%	86%
	P (-2.377) = 0.021	P (-3.930) = 0.000	
Question 11	6%	62%	67%
	P (-8.287) = 0.000	P (-0.554) = 0.582	
Question 12	22%	90%	60%
	P (-11.546) = 0.000	P (4.294) = 0.000	
Question 13	29%	70%	90%
	P (-5.347) = 0.000	P (-3.193) = 0.002	
Question 14	28%	68%	90%
	P (-5.347) = 0.000	P (-3.193) = 0.002	

First, we show the results regarding H1A

We found significant differences in students' knowledge between the 2017 and 2018 surveys in the treatment school: question 9 - $P = 0.01$, question 10 - $P = 0.001$, question 12 - $P = 0.000$ and question 13 - $P = 0.002$.

Table 6-5 shows that in 2018 a higher percentage of students gave the right answer than 2017 for questions 9, 10, 13 and 14. We found that the percent of right answers decrease for question 12, where 90 percent of the students gave the right answer at survey 3 in 2017 and only 60 percent gave the right answer for survey 4 in 2018. In addition, we found that for question 11 the percentage of students who gave the correct answer did not change between surveys 3 and 4.

Student's names were recorded in both surveys and served as individual IDs for each student to evaluate their scores from the two different years in which surveys were conducted. To evaluate the difference between student's knowledge, the study used the same 6 questions from questions 9 to 14.

Hypothesis 1A, the study found that there were significant differences between students who chose the correct answers in surveys 3 and 4 in the treatment school. We found that the student's knowledge levels increased at survey 3 and still increased at survey 4 after 1 year from environmental activities in almost all questions.

Second, we show the results regarding H2A

Treatment school – Reason for recycle – Q12

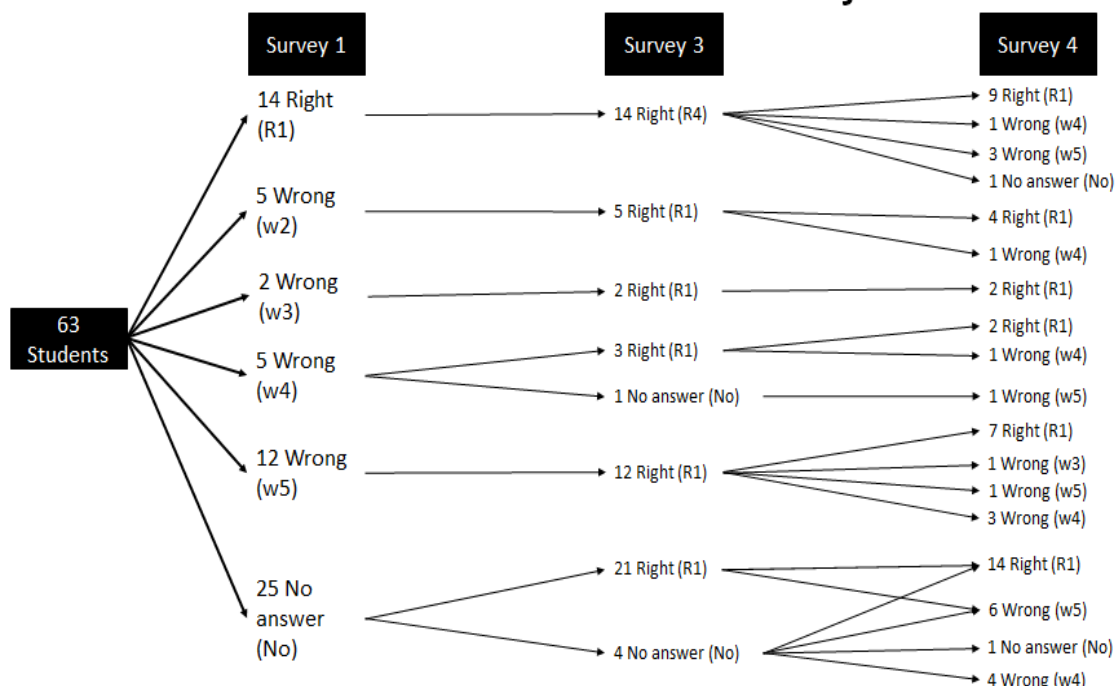


Figure 6-11 Treatment student answers in recycle for profit question

This question estimated student knowledge about the identification of 3Rs. The study prepared 5 options for answers that described “Recycle for profit”

Option (1) – Right (R1) is “To reduce the amount of waste that goes to a landfill”.

Option (2) – Wrong (W2) is “To earn money”.

Option (3) – Wrong (W3) is “For fun”.

Option (4) – Wrong (W4) is “For school donations”.

Option (5) – Wrong (W5) is “To reduce space”.

In most urban areas in Vietnam, municipal solid waste (MSW) is not officially sorted at source. Few households separate their solid waste by selling bottles, jars, metal, and paper to scrap collectors. For this question, the study chose W4 and W5 that followed school activities and student daily life. We found that at survey 4 the students who gave right the answer reduced from 90% to 60% at survey 3. The student selected answers W4 and W5. That was difficult

for students to change their answers if the answer was related to school activities and daily life. However, the environmental education changed student knowledge to choose the right answer at survey 3, but students still chose the wrong answer at survey 4 because of school and daily life activities.

Thirst, we show the result regarding H3A

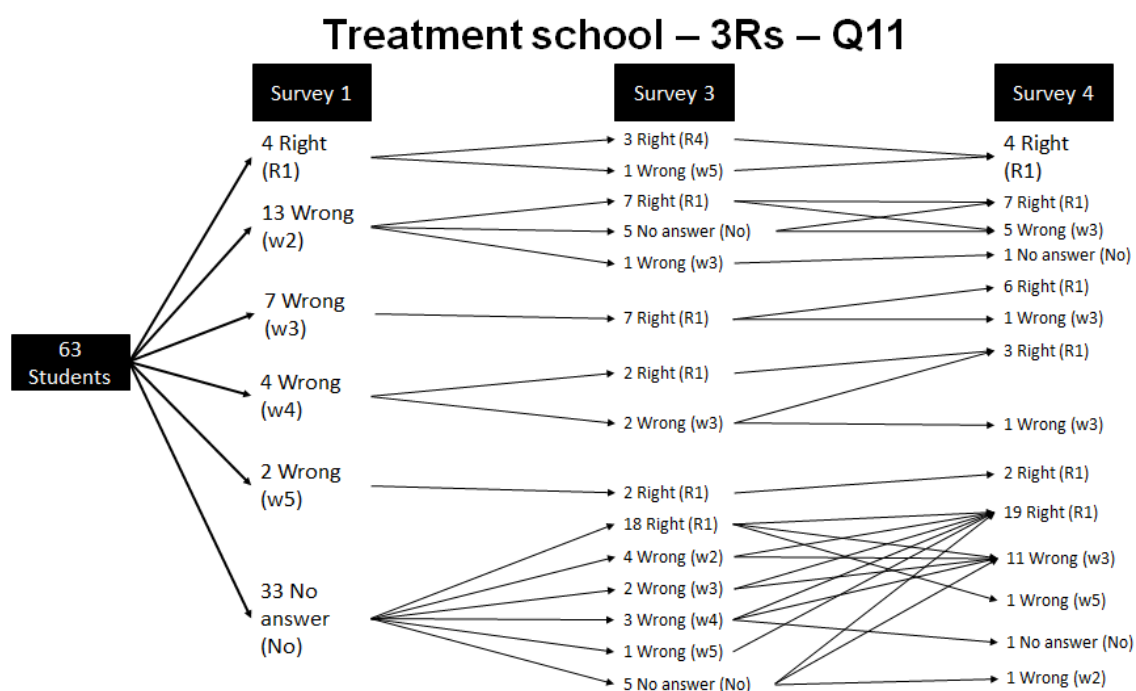


Figure 6-12 Treatment student answers for 3Rs question

This question estimated student knowledge about identification of 3Rs. The study prepared 5 options as answers that asked “what does 3Rs mean?”

Option (1) – Right (R1) is “Recycle, reuse and reduce waste”.

Option (2) – Wrong (W2) is “Throw waste in the rubbish bin”.

Option (3) – Wrong (W3) is “Recycle, reuse and separation waste”.

Option (4) – Wrong (W4) is “Reuse and reduce waste”.

Option (5) – Wrong (W5) is “Protect the environment”.

“3Rs concepts” was new knowledge that students got from environmental education. Before the environmental education lesson, 6% of the students gave the correct answer, 41% selected a different wrong answer, and 53% did not give an answer. We found that in 35% of the students that gave the wrong answer, 72% students selected option wrong 3 “Recycle, reuse and separation waste” at survey 4. The study considered that because Vietnam does not have separation and treatment systems, the students did not change their habits after environmental education. This made students more confused when they answered this question. Additionally, students who selected the wrong answer (W2), are not expected to change their answers at survey 3 and 4.

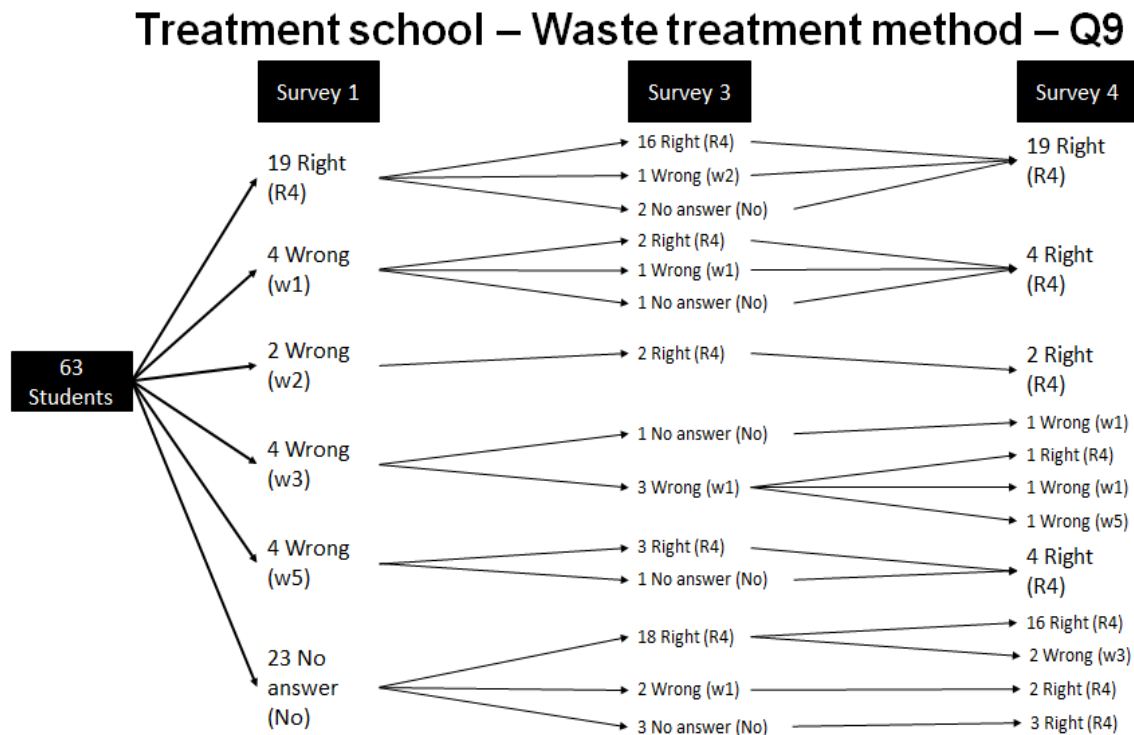


Figure 6-13 Treatment student answers in waste treatment method question

The question about waste treatment method evaluated student knowledge about waste discharge systems in Da Nang city. The study prepared 5 options with answers that were related to the environmental situation in Vietnam, especially Da Nang city. Figure 6-13 showed the changing of student answers in survey 1, 3 and 4.

Option (1) – Wrong (W1) is “to an aquifer where it is buried”. In Vietnam, according to the National Environment Report 2011-2015, the rate of household solid waste collection in urban areas reached an average of 84-85%. In rural areas, the collection rate is 40-55% varying by localities. In small towns it could reach 60- 80% while in remote mountainous area it is even below 10% (Nguyen T. T., 2017). In rural Vietnam, people still bury waste in their garden. We selected this option as an answer because this option was related to the solid waste management situation in Vietnam. We found that before EE just 6% of the student chose this answer, and 3% selected this answer at survey 4.

Option (2) – Wrong (W2) is “It is dumped into ocean”. The study selected this option as an answer because Da Nang city is near the beach, where from the city centre it takes 10 minutes to the beach by bike or car. According to UNDP 2018, “Vietnam joins hands to protect the ocean”, Da Nang city one of the first cities to clean and protect its ocean environments (UNDP, 2018). Every day at the beach, citizens can hear over the radio to protection and keep the beach clean from the local government. If you visit Da Nang’s beaches, you would not see waste at the beach. The study observed that information dissemination from the local government improved the citizen’s knowledge on solid waste management regarding the ocean. Only 3% of the students choose this answer as an option before EE and no student selected this answer in survey 4.

Option (3) – Wrong (W3) is “It is recycled to make plastic”. In Vietnam, waste separation is an informal activity. Citizens can separate waste individually at their house, but when put out all garbage will be collect by the same truck and carried to the landfill. For this answer, the study found that if the student choses this wrong answer, it’s difficult to change their answer at survey 3 and survey 4. The study observed the environmental around the treatment and control school location. We found that the area around 2 of the schools have 4 big individual recycle companies. We considered that the students always see recycling

companies in their daily life. The students believed that this was the right answer. In addition, recycling activities in Vietnam are informal activities. Some houses will purchase plastic, paper and cans for scavengers to make plastic. The study considers that common activities in student's daily lives will impact their answer.

Option (4) – Right (R4) is “To a Khanh Son landfill”. Khanh Son landfill is the only landfill where the waste generated in Da Nang city will go after collection at the household. In survey 1, 19 students gave this as a correct answer. In addition, in the lesson, when we asked students about this information, just 5 of 19 students were unsure about this answer. But after EE, students' right answers increased their right answer to become 65%.

Option (5) – Wrong (W5) is “To farmer who use it as fertilizer”. For the 3Rs project between Vietnam (Ha Noi city) with Japan (JICA), Ha Noi city built a fertilizer factory to treat food waste (Taniguchi & Yoshida, 2011). The study wanted to gather student ideas about this option. The study found that just 6% chose that option in survey 1, and 1% selected it in survey 4. We found that the “3Rs project” information was not promoted in other cities in Vietnam.

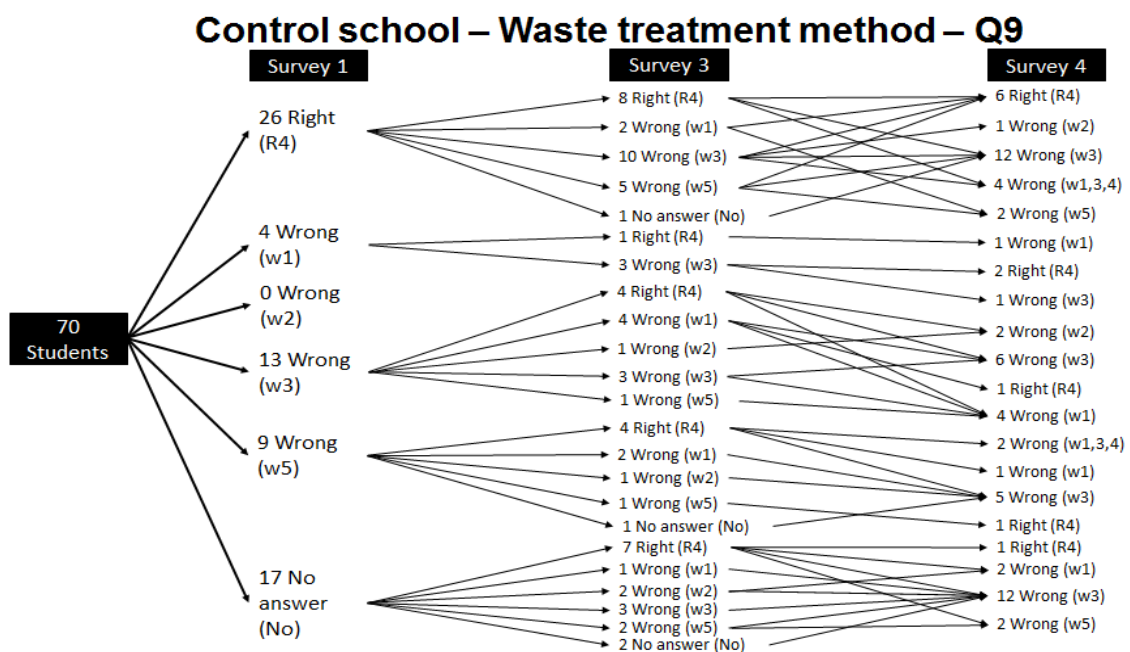


Figure 6-14 Control students' answers to waste treatment method question

Figure 6-14 showed the change in answers from the control school. The study found some similarities between students who gave the wrong answer at the treatment and control schools for this question. We found that 61% of the students in the control school chose option 3 – W3 in survey 4. We observed that the students saw the area where waste is collected to make plastic around their house. We considered this as one of the reasons why the students selected this option as opposed to another.

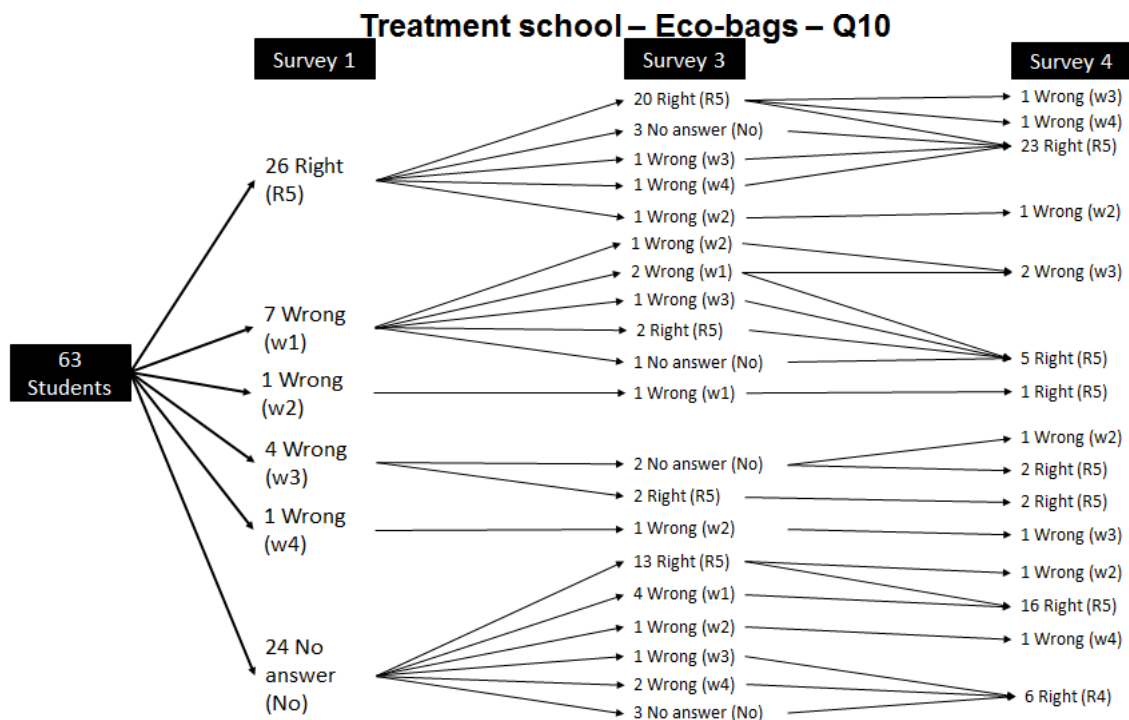


Figure 6-15 Treatment student answers in Eco-bag question

This question estimated student knowledge about identification of an eco-bag. The study prepared 5 answers with options that described, “What is an Eco-bag?”

Option (1) – Wrong (W1) is “A nylon bag that can be used only once”.

Option (2) – Wrong (W2) is “A paper bag that can be used only once”.

Option (3) – Wrong (W3) is “A cloth bag that can be used only once”.

Option (4) – Wrong (W4) is “A plastic bag that can be used only once”.

The study found that in 4 wrong options, the highest option was the nylon bag at 11%, the study observed that in Vietnam, nylon bags are used everywhere and so it is common knowledge that students observe every day. In addition, the students studied that using the nylon bag has a negative impact on the environment, but no student chose this option in survey 4.

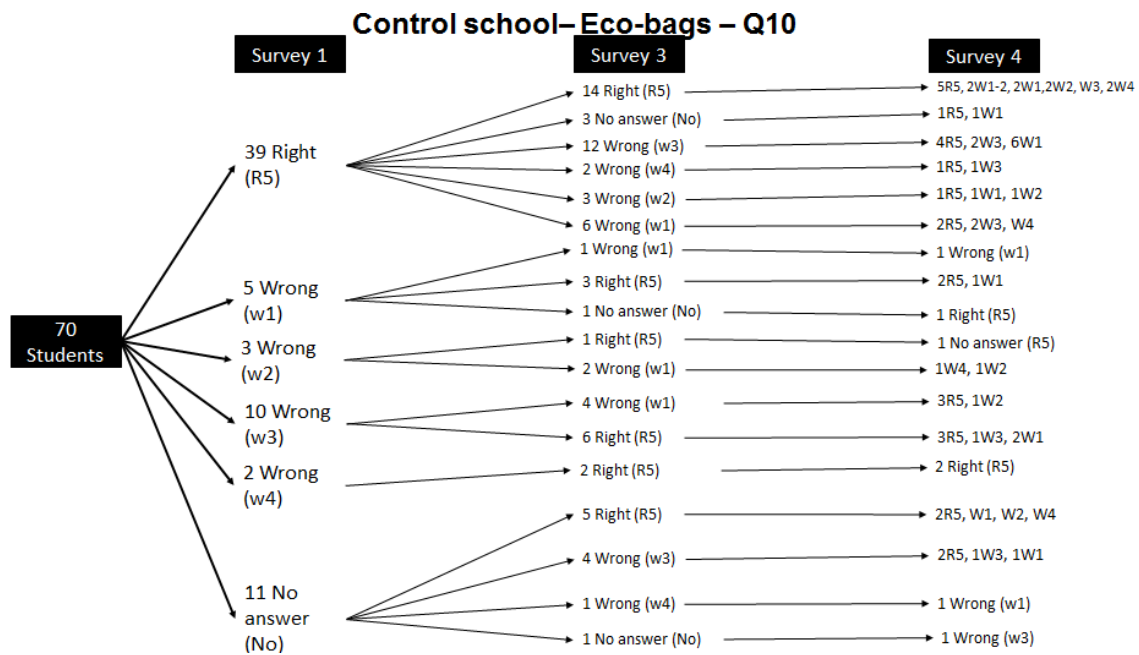


Figure 6-16 Control student answers in Eco-bag question

The eco-bag systems appeared in some big super markets in Da Nang city for a few years. We observed that students in the control and treatment schools gave more right answers for this question in survey 1, with 41% at the treatment school and 55% at the control school.

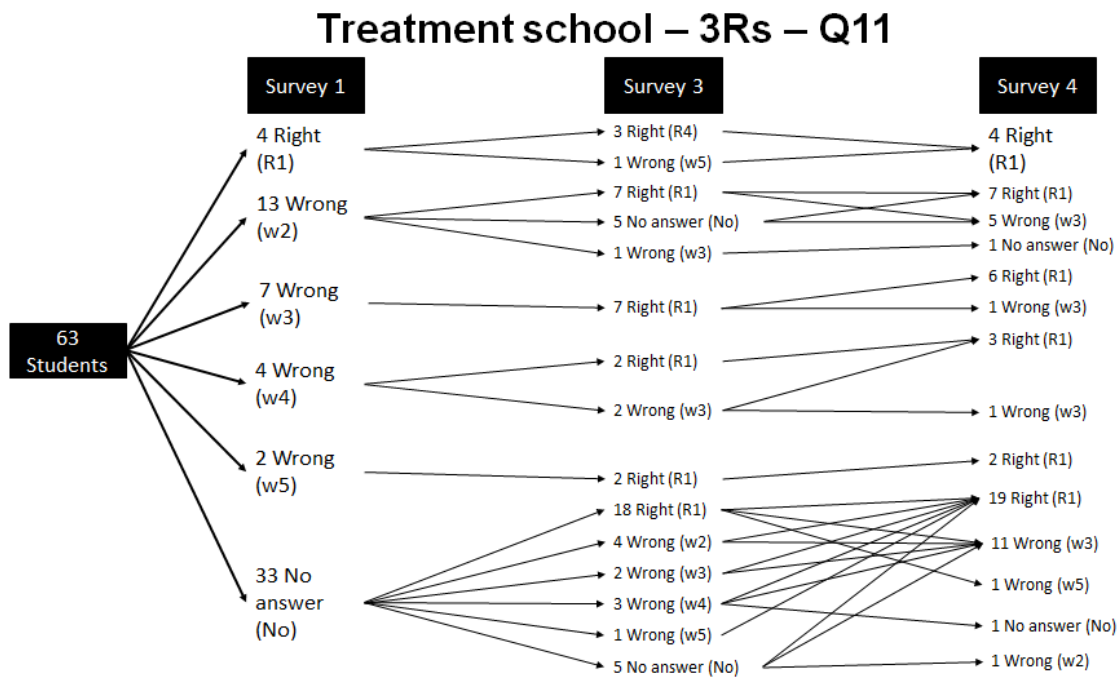


Figure 6-17 Treatment school student's answers for the 3Rs question

This question estimated student knowledge about the identification of 3Rs. The study prepared 5 answers with options to reply to “what does 3Rs mean?”

Option (1) – Right (R1) is “Recycle, reuse and reduce waste”.

Option (2) – Wrong (W2) is “Throw waste in the rubbish bin”.

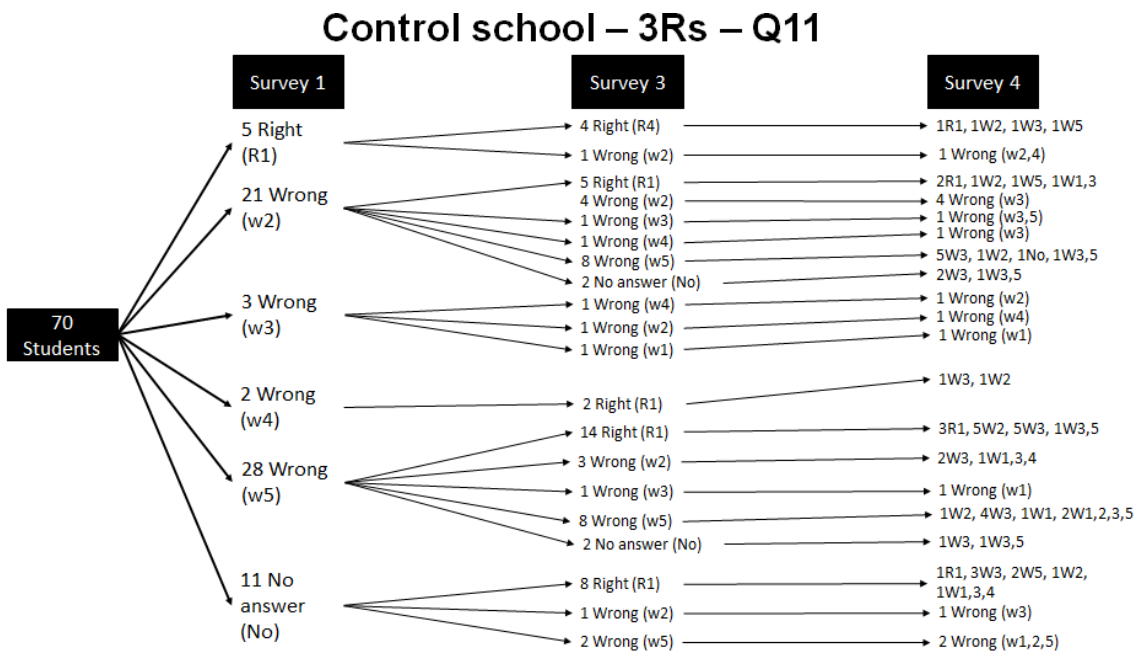
Option (3) – Wrong (W3) is “Recycle, reuse and separation waste”.

Option (4) – Wrong (W4) is “Reuse and reduce waste”.

Option (5) – Wrong (W5) is “Protect the environment”.

The “3Rs concept” was new knowledge that students got from EE. Before the EE lesson, 6% gave the right answer, 41% selected other wrong answer, and 53% of the students did not give any answer. We found that in 35% of the students who gave the wrong answer, 72% selected wrong 3 “Recycle, reuse and separation waste” at survey 4. The study considered that because Vietnam does not have separation and treatment systems, the students did not have a chance to practise after EE. For this reason, students got confused when they answer this

question. Additionally, students who selected the wrong answer in W2, would unlikely change their answers in surveys 3 and 4. The study found that if students did not give an answer for survey 1, the student did not change their answer at surveys 3 and 4 to the correct answer.



Treatment school – Reason for recycle – Q12

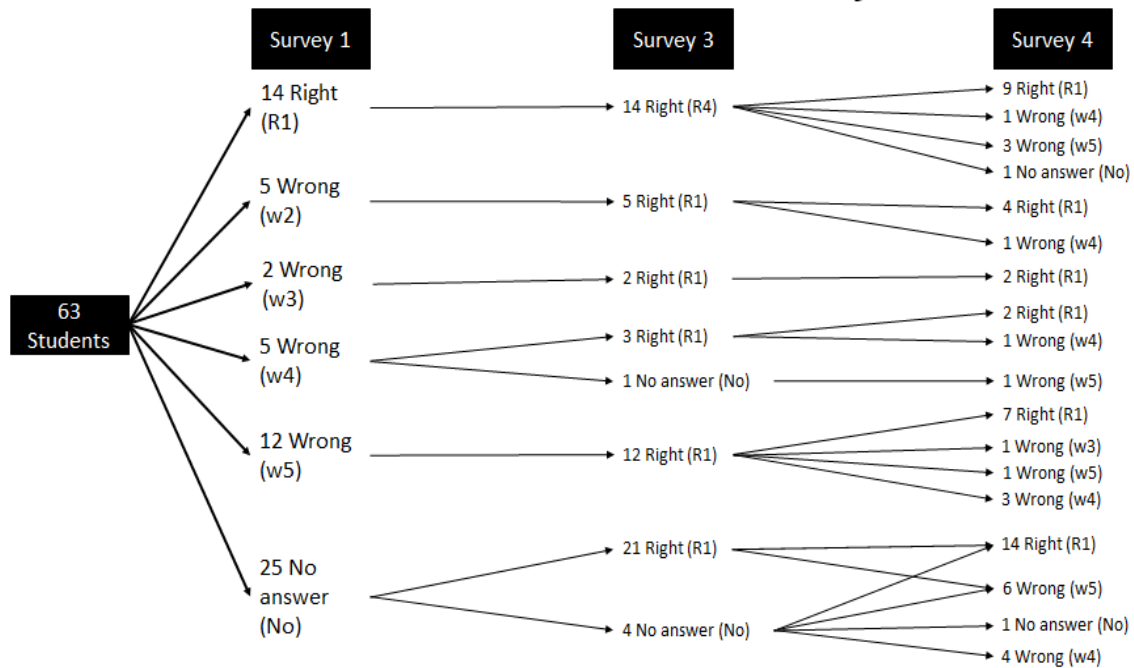


Figure 6-19 Treatment student answers for reason for recycling question

This question estimated the student's knowledge about the reason for recycling and their thoughts on the reason why they need to recycle waste. The study prepared 5 answer options for "Why do we need to recycle?"

Option (1) – Right (R1) is "To reduce the amount of waste that goes to a landfill".

Option (2) – Wrong (W2) is "To earn money".

Option (3) – Wrong (W3) is "For fun".

Option (4) – Wrong (W4) is "For school donations".

Option (5) – Wrong (W5) is "To reduce space".

Of the 5 options provided, the study chose option 1 as the right answer but options 4 and 5 are common activities in the student's daily life. As a result, of the 35% who got the wrong answer, 45% selected option 4 and 47% selected option 5.

Control school – Reason for recycling – Q12

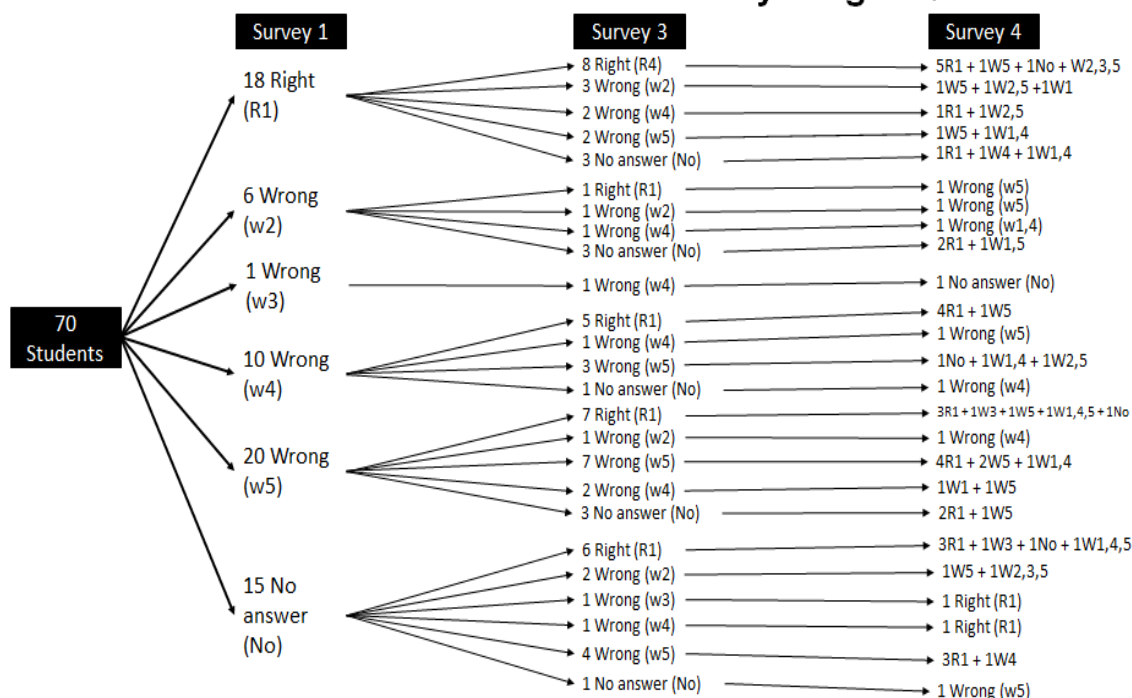


Figure 6-20 Control student's answers for reason for recycling question

At the control school, we found that most of the students selected option wrong 4 and wrong 5. We concluded that these answers are related to student daily life.

Environmental education was promoted to change student behaviour and we believe that our environment education had a positive impact and generated good results for 4th grade students in Da Nang, Vietnam.

Environmental knowledge about the reason for recycling found no significant difference between the treatment and control schools. We observed that waste separation did not exist in Vietnam, and waste recycling was not a common activity or concept in school and society. For this reason students did not care and were confused about waste recycling.

The findings of this study suggest that environmental education should be promoted to young students in a classroom.

6.4.6 Short discussion about student knowledge when they join one-time EE and 6-month EE.

In this discussion, we used an eco-bags question which had the nearest meaning to the answers, shown in Figure 6-21.

One-time EE question	6-month EE question
5. What is the eco bag?	10. What is an eco-bag?
Eco bag is:	(a) A nylon bag that can be used only once
<input type="checkbox"/> <u>The bag can reuse many time</u>	(b) A paper bag that can be used only once
<input type="checkbox"/> The normal plastic bags	(c) A cloth bag that can be used only once
<input type="checkbox"/> The paper bags	(d) A plastic bag that can be used only once
<input type="checkbox"/> I don't know	(e) <u>A plastic bag or cloth bag that can be reused many times</u>

Figure 6-21 Nearest meaning question in 6-month and one-time EE questionnaire survey.

We showed at chapter 3 that after joining a one-time class, students increased their knowledge of solid waste management, but after 3 months from EE, student knowledge decrease. Again, we show the eco-bags example bellow.

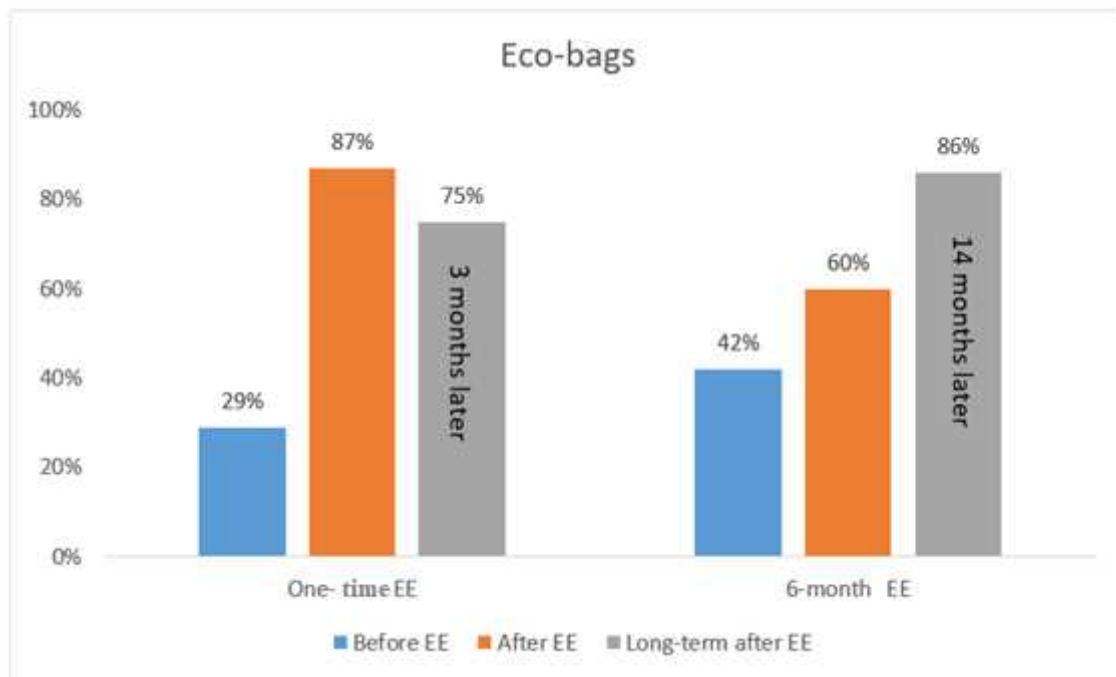


Figure 6-22 Changing of student knowledge

After one-time EE, students increased high right answer compare with 6-month EE, but after 3 months from EE activities, student knowledge had a decreasing phenomenon. In addition, after one year from the 6-month EE, students increased their knowledge. The study provided some note book cover picture about EE activities for students after EE lessons at one-time EE and 6-month EE. We found that some students still used our note book after 14 months from EE. We observed this was one of reason why student still remembered and increased knowledge after 14 months EE. In addition, we observed that 6 months joined lessons and practises about solid waste management helping student to memory knowledge longer.

Because of some divergence in the questions, and very little data was collected. The study could use a statistical method to evaluate the difference between one-time and 6-month EE. But from the results in chapter 3 and chapter 5, we found that one-time and 6-month EE had a good impact on student knowledge, and 6-month EE had a more lasting effect on student knowledge than one-time EE.

6.5 Limitation

The study had some limitations, such as: students could not have more practices after their environmental education lesson, and therefore could not understand fully the reason for recycling. For future research, we need to develop more activities for students during the year, and we should discuss the impact of waste on human life.

6.6 Conclusions

C.5 Evaluating the effects of EE after 14 months: Focused on solid waste management knowledge.

H1: We found that there were significant differences in the levels of student's environmental knowledge after one year between treatment and control

schools, except for question 12 where $P = 0.165$. But overall, the students' knowledge in the treatment school increased after one year.

H2: There were no significant differences between boys and girls in their level of environmental knowledge in the treatment school.

H3: The study found there were significant differences between students who had a good score in survey 3, and good results in survey 4 in the treatment school by using paired T-Test with $P = 0.007 < 0.05$.

H4: We found that in terms of environmental behavior, the treatment school students were more influenced by practicing this behavior, than those in the control school.

H5: We found that for water saving, the treatment school's students' behaviors were more knowledgeable than those in the control school.

According the analysis of student's performance from answers, the study found that the questions and the answers are related with a student's daily life or behavior. If the student gave the wrong answer that is related to their behavior, it is unlikely they would change their answers at survey 3 and survey 4. In addition, in the new knowledge questions, if the student was not able to give the right answers at survey 1, the student could not give the right answer at survey 3 and survey 4 either.

Finally: Students knowledge after 6-month of EE had more permanence than one-time EE.

Chapter 7 CONCLUSION AND RECOMMENDATION

7.1 Contribution to knowledge

Having discussed the findings in relation to the statement problem questions and the objectives, there are 3 keys conclusions to be drawn from the research with regards to EE at elementary school in Da Nang, Vietnam.

1. Characteristics of EE in Vietnam

A.1 Review literature (Chapter 2)

- Made discussion on section 2.2 Characteristics of childhood development. This area was considered as vital in finding subjects of the study. The study focused on 4th and 5th grade student at elementary school.
- Based on the theories of reasoned action and planned behavior. The study wanted to create and develop the model to estimate the impacts on student intention and behavior when they participated in EE.
- Section 2.4 Theory on EE, section 2.5.1 Workshop and section 2.5.2 Drawing activities. These combined to create and develop EE for elementary students.

A.2 Summary of Vietnamese textbook and EE contents from elementary textbook (Chapter 2)

- According Japanese EE example and experience from activities that were done in Southeast Asia, the study created and developed EE activities for elementary student in Da Nang, Vietnam.

2. Create and develop an EE in Vietnam

B.1 Develop one time education course (Chapter 3)

- The study developed EE activities in 30 minutes for 5th grade student.
- The study created a separation game to give students a chance to participate in solid waste management activities.

B.2 Develop 6-month workshop course (Chapter 5)

- In June, 2016 we had a chance to attend an EE lesson at “あやめが丘小学校”, Kitakyushu, Japan. From October 2016 to April 2017, the study provided a 6-month workshop in EE at the treatment school in Da Nang.

- The study collected the survey before and after EE at Japanese school. The EE gave students deep understanding of solid waste where 100% said that knew about separation waste at home, compare with 67% in survey 1

- Students had 4 lessons to understand the environmental problem in Da Nang and Vietnam.

- Students joined two practice activities from EE: (1) waste separation game, and (2) newspaper activities.

3. Evaluate the impact of environmental activities for elementary student in Da Nang

C.1 Develop evaluation method (Chapter 3 and chapter 5)

- Using the treatment – control design to collect data and estimate impact of one-time EE and 6-month EE to elementary student in Da Nang, Vietnam. for one-time EE activities, the study surveyed 591 students in 3 elementary schools in Da Nang, Vietnam. The study surveyed 157 students in 2 schools for 6-month EE.

- We did EE in 2 groups of students and 1 group used the waste separation game and 1 group had no game.

- The study observed student’s newspaper pictures and collected data from presentations to make a newspaper analysis on 6-month EE.

- The study made a model to analyse student intention based upon theory of planned behaviour for 6-month EE.

C.2 Measurement of the impacts of EE from textbook (Chapter 3)

- The study provided a summary of environmental contents from Vietnamese textbook.

- We used chi-square tests to examine the effect of the environmental lesson in schools. We found that the environmental lesson from the school had a good

impact on students. They could remember EE knowledge from the school lesson after 1 year.

C.3 Evaluation of one-time education (Chapter 3)

- The study found that students increased their knowledge on solid waste after joining EE activities. But after 3 months, the students' knowledge decreased for eco-bags and food waste. In schools that had EE, the students improved their knowledge on solid waste compared to the school that did not have EE .
- The study did not found difference on student knowledge from game and without game group. However, students who join in game activities were enjoyed EE activities than without game group.
- The results of the checklist showed that 95% of students like to join environmental activities, with 87% wanting to attend again.

C.4 Evaluation of 6-month education (Chapter 5)

- Impacts student knowledge: Before EE, the study had a low impression on solid waste management. After EE, the students in the treatment school increased their knowledge on solid waste management.
- Compare student knowledge by treatment - control design. After 6 months of environmental education activities, student's knowledge in the treatment school increased by 64% for 3Rs and 90% for reason for recycling. Student knowledge in the control school did not change and decreased when compared with survey 1 by 9% for 3Rs, and by 9% for reason for recycling.
- Student showed their deep impression on workshop EE on their newspaper. Student drew many elements related with solid waste in their newspapers. The majority drew rubbish (100%) and dustbin (62.5%), 75% included people, 50% included trees and 43.5% included fruits and parks.
- The study used SEM to assess the intention model. We found a relationship between food waste (intention) and separation waste and using eco-bags (attitude toward behavior).

C.5 Evaluating the effect of EE after 14 months (Chapter 6)

- Used the Mann-Whitney U test to assess the difference between treatment and control schools. We found that there were significant differences in the levels of students' environmental knowledge after one year. We found that the treatment school students were more influenced than the control school students on EE knowledge.
- Comparing student knowledge of treatment – control school on survey 3 and survey 4. Our results show that treatment school student's knowledge about solid waste management increased after one year while control school student knowledge decreased after one year. The study found that treatment student's in survey 4 (2018) a higher percentage of students gave the right answer than survey 3 (2017) for the eco-bag question.
- We found that between genders there were no significant differences in the level of student environmental knowledge in the treatment school.
- According the analysis of student's performance on answers, the study found that at the questions and the answers are related to student's daily life or behavior. If the student gave the wrong answer that is related with their behavior, student will get difficult to change their answer at survey 3 and survey 4. In addition, for the new knowledge questions, if student was not able to give the right answers at survey 1, they could not give the right answer at survey 3 and survey 4 neither.
- The study showed that lectures influenced new knowledge of solid waste management more than group games. The knowledge that is related to daily life is more influenced by group games than lectures.
- The study found that a student's knowledge after 6 months of EE were more stable than one-time EE.

7.2 Recommendations

The conclusions gave some implication of this research for elementary schools in Da Nang, Vietnam, and some recommendations are presented.

1. Start EE at elementary schools: “The goal of EE: aid citizens in becoming environmentally knowledgeable”. EE should improve knowledge current environmental problem for students.

Recommendation: (1) The Government should include solid waste management knowledge in the textbook. Although, textbooks from MOET included environmental knowledge, this knowledge was too old compared to the current situation. With old knowledge, students cannot pay attention to practice solving environmental issues. (2) MOET should require elementary schools to have 1 lesson per semester for environmental education. (3) MOET should implement the workshop method for teaching EE to students. With old knowledge, student cannot pay attention to practice solving environmental issues. The school can provide lectures to improve new knowledge on solid waste management, which is related to daily life knowledge; the school can provide more game activities.

2. Evaluation EE at elementary school: Students get to practice EE knowledge in their daily life.

Recommendation: (1) The school should include the student evaluation results to estimate student score or ethic to improve student intention on EE activities.

3. Motivation to change implication: Attitudinal and behavioral changes take time but it is important to consider factors that would encourage and motivate the student to change the attitude-behavior gap.

Recommendation: Researchers should conduct more studies in exploring the motivations of students to change their attitudes and behaviors towards the environment in various contexts in Da Nang.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2):179-211.
- Ajzen, I., & Fishbein, M. (2000). Attitudes and the Attitude-Behavior Relation: Reasoned and Automatic Processes. *European Review of Social Psychology*, 11(1), 1-33.
- Ajzen, I., & Fishbein, M. (2005). The Influence of Behavior on Attitudes. In D. Albarracin, B. T. Johnson, & M. P. Zanna, *The handbook of attitudes* (pp. 125-173). New York: Psychology Press.
- Andreou, N. (2018, 6 22). *Eco-Schools*. Retrieved from ecoschools.global: <https://www.ecoschools.global/news-stories/2018/6/21/thai-schools-reached-the-global-standard-for-environmental-education>
- APEC. (2014). *Policy review for low-carbon town development project in Da Nang, Vietnam: Report for the APEC Energy Working Group*. Singapore: Asia-Pacific Economic Cooperation (APEC).
- Asmawati, D., Nor Ba'yah, K. A., & Fatimah, Y. (2012). Environmental Awareness and Education: A Key Approach to Solid Waste Management (SWM) – A Case Study of a University in Malaysia. In L. F. Rebellon, *Waste Management - An Integrated Vision* (pp. 101-112). London: IntechOpen.
- Berg, K. V., Duong, T. C., Nielsen, J. M., Skov, C., Simonis, G., Nguyen, T. T., et al. (2018). *Đánh giá công tác quản lý chất thải rắn sinh hoạt và chất thải công nghiệp nguy hại*. The World Bank.
- Berk, L. E. (1997). *Child development*. Boston: Allyn & Bacon.
- Binstock, M. (2006). *A Survey of National Environmental Education and Education for Sustainable Development Laws and Policies: Lessons for Canada*. Toronto: Canadian institute for environmental law and policy.
- Brookfield, S. D. (1993). Understanding consulting as an adult education process. *New directions for Adult & Continuing Education*, 58:5-13.
- CALPRO, C. (2017). *Section 2a: Workshop/Presentation Approach*. California : California Department of Education, Adult Education Office (CALPRO).
- Chandran, R., & Gunawardena, C. (2017). *The National Environmental Education Action Plan 2018-2040 (VERSION 1)*. Quezon: The Republic of the Philippines Department of Environment and Natural Resources Environmental Management Bureau.
- Chen, J. J.-L. (2008). Grade-Level Differences: Relations of Parental, Teacher and Peer Support to Academic Engagement and Achievement Among Hong Kong Students. *School Psychology International*, 29(2):183-198.
- Cherney, I. D., Seiwert, C. S., Dickey, T. M., & Flichtbeil, J. D. (2006). Children's Drawings: A mirror to their minds. *Educational Psychology*, 26(1):127-142.

- Chin, C., & Teou, L.-Y. (2009). Using Concept Cartoons in Formative Assessment: Scaffolding students' argumentation. *International Journal of Science Education*, 31(10), 31(10):1307-1332.
- Corey, S. M. (1937). Professed attitudes and actual behavior. *Journal of Educational Psychology*, 28(4):271-280.
- Curea, C. (2017). Sustainable Societies and Municipal Solid Waste Management in Southeast Asia. In P. Schroeder, K. Anggraeni, S. Sartori, & U. Weber, *Sustainable Asia Supporting the Transition to Sustainable Consumption and Production in Asian Developing Countries* (pp. 391-415). World Scientific.
- Curriculum Research Center of Japan. (2007). *Teacher's guide for environmental education (elementary school edition)*. Japan: Japan Ministry of Education .
- Dao, H. T., Downs, T. J., & Delauer, V. (2013). Sustainable solid waste management in Da Nang, Vietnam: The 3R (reduce, reuse, and recycle) approach focusing on community participation. *Fourteenth International Waste Management and Landfill Symposium* (pp. 1-25). Cagliari, Italy: CISA.
- Davis, J. M. (1998). Young Children, Environmental Education, and the Future. *Early Childhood Education Journal*, 26(2):141-154.
- Davis, J., & Cooke, S. (1998). Parents as partners for educational change: the Ashgrove Healthy School Environment Project. In B. Atweh, S. Kemmis, & P. Weeks, *Action research in practice* (pp. 59-85). London: Routledge.
- Dempster, E. R., & Stears, M. (2013). An analysis of children's drawings of what they think is inside their bodies: A South African regional study. *Journal of biological education*, 48(2):71-79.
- Development Alternatives Inc (DAI). (2006). *Comparative assessment. Community based solid waste management (CBSWM) Medan, Bandung, Subang and Surabaya*. the United States Agency for International Development.
- Dimitrijević, J. D., Filipović, S., & Stanisavljević, J. D. (2016). An Analysis of Students' Drawings for the Purpose of Considering the Efficiency of Teamwork (Programme Content: Marine Life Community). *Journal of Subject Didactics*, 1(1):25-38.
- Eccles, J. S. (1999). The Development of Children Ages 6 to 14. *The Future of Children*, 9(2):30-44.
- Eggen, P., & Kauchak, D. (2013). *Educational Psychology: Windows on Classrooms*. Pearson India.
- Einstein, D. F. (1995, January 16). *The Campus Ecology Research Project: An Environmental Education Case Study*. Madison: University of Wisconsin-Madison.
- Eneji, C.-V., & Akpo, D. (2017). Historical Groundwork of Environmental Education. *International Journal of Continuing Education and Development Studies (IJCEDS)*, 3(1):110-123.

- Engleson, D. C., & Yockers, D. H. (1994). *Environmental Education. A Guide to Curriculum Planning. Second Edition. Bulletin Number 94371*. Wisconsin Dept. of Public Instruction.
- Erhabor, N. I., & Don, J. U. (2016). Impact of Environmental Education On the Knowledge and Attitude of Students Towards the Environment. *International Journal of Environmental & Science Education*, 11(12):5367-5375.
- Evers, T. (2018). *WISCONSIN STANDARDS FOR Environmental Literacy & Sustainability*. Wisconsin Department of Public Instruction.
- Farokhi, M., & Hashemi, M. (2011). The Analysis of Children's Drawings: Social, Emotional, Physical, and Psychological aspects. *2nd World Conference on Psychology, Counselling and Guidance* (pp. 2219-2224). Antalya: Procedia - Social and Behavioral Sciences.
- Fatma, S., & Semra, S. (2013). A study on environmental knowledge and attitudes of teacher. *5th World Conference on Educational Sciences - WCES 2013* (pp. 2379–2385). Rome: Procedia - Social and Behavioral Sciences.
- Fishbein, M. (2000). The role of theory in HIV prevention. *Psychological and Socio-medical Aspects of AIDS/HIV*, 12(3):273-287.
- Garg, N. (2013). Waste management for urban Horticulture. In H. P. Sumangla, S. K. Malhotra, & P. Chowdappa, *Urban and PeriUrban Horticulture- A Perspective* (pp. 61-67). New Delhi: Confederation of Horticulture Association of India.
- Gillett, M. (1977). *The Tbilisi Declaration*. Tbilisi: the United Nations Educational, Scientific and Cultural Organization.
- Goldman, D., Yavetz, B., & Pe'er, S. (2014). Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. *International Journal of Environmental and Science Education*, 9(4):369-382.
- Grodzinska-Jurczak, M., Bartosiewicz, A., Twardowska, A., & Ballantyne, R. (2003). Evaluating the Impact of a School Waste Education Programme upon Students', Parents' and Teachers' Environmental Knowledge, Attitudes and Behaviour. *International Research in Geographical and Environmental Education*, 12(2), 106-122.
- Günindi, Y. (2012). Environment in My Point of View: Analysis of the Perceptions of Environment of the Children Attending to Kindergarten through the Pictures They Draw. *International conference on new horizons in education* (pp. 594-603). Prague: Procedia - Social and Behavioral Sciences.
- Harold, J. H. (1982). The effect of environmental education instruction on children's attitudes toward the environment. *Science Education*, 66(5), 66(5):689-692.
- Hoang, T. X., Do, A. H., & Perera, O. (2009). *Sustainable Public Procurement Preparedness Assessment in Vietnam: A reference to the timber industry*. Manitoba, Canada: The International Institute for Sustainable Development (IISD).
- Hopperstad, M. H. (2008). How children make meaning through drawing and play. *Visual Communication*, 7(1):77-96.

- Hu, L.-t., & Bentler, P. M. (2009). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1):1-55.
- Huitt, W., & Hummel, J. (2003). Piaget's Theory of Cognitive Development. Valdosta, Georgia, United States.
- Hungerford, H. R., Peyton, R. B., Bluhm, W., & Volk, T. (1994). *Procedures for Developing an Environmental Education Curriculum*. the United Nations Educational, Scientific and Cultural Organization.
- Imamura, M. (2017). Beyond the Limitations of Environmental Education in Japan. *Educational Studies in Japan: International Yearbook*, 11:3-14.
- Japan International Cooperation Agency, (. (2018). *Socialist Republic of Viet Nam The Project for Capacity Development on Integrated Management of Municipal Solid Waste in Vietnam* . Japan International Cooperation Agency (JICA) .
- JICA. (2006). *Annual Report 2006*. Japan International Cooperation Agency.
- JICA. (2014). *The Preparatory Survey on Wastewater Management and Solid Waste Management for Da Nang City The Socialist Republic of Viet Nam*. Japan International Cooperation Agency (JICA).
- Kaffashi, S., Yacob, M. R., Clark, M. S., Radam , A., & Mamat, M. F. (2015). Exploring visitors' willingness to pay to generate revenues for managing the National Elephant Conservation Center in Malaysia. *Forest Policy and Economics*, 56:9-19.
- Kaiser, F. G., Oerke, B., & Bogner, F. X. (2007). Behavior-based environmental attitude: Development of an instrument for adolescents. *Journal of Environmental Psychology*, 27(3):242-251.
- Knapp, D. (2000). The Thessaloniki Declaration: A Wake-Up Call for Environmental Education? *The Journal of Environmental Education* , 31(3), 31(3):32-39.
- Kodama, T. (2017). Environmental Education in Formal Education in Japan. *The Japanese Society of Environmental Education*, 26(4):21-26.
- Kojima, M. (2016). Environmental Issues in Southeast Asia. In T. Shimaoka, T. Kuba, H. Nakayama, T. Fujita, & N. Horii, *Basic Studies in Environmental Knowledge, Technology, Evaluation, and Strategy* (pp. 55-67). Springer Japan.
- Leeming, F. C., Dwyer, W. o., & Bracken, B. A. (2010). Children's Environmental Attitude and Knowledge Scale: Construction and. *The Journal of Environmental Education*, 26(3):22-31.
- Leroy, M. L., & Vuong, C. C. (2015). *Solid waste typology and management in Ha Noi*. Ha Noi: World leader in reproduction biotechnologies.

- Liefländer, A. K., & Bogner, F. X. (2014). The effects of children's age and sex on acquiring pro-environmental attitudes through environmental education. *The Journal of Environmental Education*, 45(2):105-117.
- Liu, S., & Guo, L. (2018). Based on Environmental Education to Study the Correlation between Environmental Knowledge and Environmental Value. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(7):3311–3319.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1(2):130–149.
- Marks, D. (2019, June 26). *Southeast Asia's plastic waste problem*. (EastAsiaForum) Retrieved October 30, 2019, from East Asia Forum Economics, Politics and Public Policy in East Asia: <https://www.eastasiaforum.org/>
- Marquardt, J. (2010). *Think Global, Act Local? Domestic Politics in the Philippines and their Impact on Implementing the Clean Development Mechanism*. VDM Verlag Dr. Müller.
- Martin, G. (1975). A review of objectives for environmental education. In G. Martin, C. E. George, & K. E. Wheeler, *Insights into Environmental Education*. (pp. 21-32). United Kingdom: Oliver and Boyd.
- Masoumeh, F., & Masoud, H. (2011). The Analysis of Children's Drawings: Social, Emotional, Physical, and Psychological aspects. *2nd World Conference on Psychology, Counselling and Guidance*. 30, pp. 2219-2224. Antalya: Procedia - Social and Behavioral Sciences.
- McCrea, E. J. (2006). *The Roots of Environmental Education: How the past supports the Future*. Environmental Education and Training Partnership (EETAP).
- McGlen, N. E., Mibrath, L. W., & Yoshii, H. (1979). Cultural differences in perceptions of environmental problems. *Technological Forecasting and Social Change*, 14(2):97-114.
- Ministry of Education and Training. (2014). *Viet Nam: Education for All 2015 National Review*. Ha Noi: Ministry of Education and Training.
- Ministry of Foreign Affairs of Japan. (2015). *A Proposal from East Asia Low Carbon Growth Partnership Dialogue*. Tokyo: Ministry of Foreign Affairs of Japan.
- Nguyen, D. H. (2018). *Assessment of waste collection systems and separate collection alternatives in Vietnam*. Okayama: Graduate School of Environmental and Life Science OKAYAMA UNIVERSITY.
- Nguyen, K. Q., & Nguyen, C. Q. (2008). *Education in Vietnam: development history, challenges and solutions*. The World Bank.
- Nguyen, L. D., Hoang, G. M., Bui, T. X., & Nguyen, H. T. (2013). Challenges for municipal solid waste management practices in Vietnam. *Waste Technology (WasTech)*, 1(1):17-21.
- Nguyen, T. P. (2019). Reviewing Vietnam Geography Textbooks from an. *Sustainability*, 11(9):1-16.

- Nguyen, T. P., & Matsui, Y. (2011). Municipal Solid Waste Management in Vietnam: Status and the Strategic Actions. *International Journal of Environmental Research*, 5(2), 5(2):285-296.
- Nguyen, T. T. (2017). *The Socialist Republic of Vietnam*. The United Nations Centre for Regional Development.
- NIER. (2018). *National Institute for Educational Policy Research 2018*. Tokyo: National Institute for Educational Policy Research, Japan.
- Novak, J. D. (1980). A Theory of Education as a Basis for Environmental Education. In R. Mournighan, M. Dudzinska, J. Barich, M. A. Gonzalez, & R. K. Black, *Chemistry for the Protection of the Environment* (p. 129). New York: Plenum Press.
- NUFFIC. (2015). *Education system Vietnam described and compared with the Dutch system*. The Dutch organisation for internationalisation in education.
- Ogata, T. (2008). *Environmental Administration in Japan and the Role of Local Governments*. Beijing: Council of Local Authorities for International Relations (CLAIR).
- Ojose, B. (2008). Applying Piaget's Theory of Cognitive Development to Mathematics Instruction. *The Mathematics Educator*, 18(1):26-30.
- Papalia, D. E., & Olds, S. W. (1996). *A child's World: Infancy Through Adolescence, Tenth Edition*. New York: McGraw-hill.
- Phan Hoang, T. T., & Kato, T. (2016). Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam. *Sustainable Environment Research*, 26:274-286.
- Phan Hoang, T., & Kato, T. (2018). Development and prototion of solid waste management education in elementary school using the Japanese model: Case study in Da Nang, Vietnam. *The 10th Asia-Pacific Landfill Symposium - The tenth anniversary* (pp. 53-63). Tokyo: APLAS Tokyo.
- Ploeg, J. V., Cauilan-Cureg, M., Weerd, M. V., & Groot, W. T. (2011). Assessing the effectiveness of environmental education: mobilizing public support for Philippine crocodile conservation. *Journal of the Society for Conservation Biology*, 4(4):313-323.
- Pwc Vietnam, & Vietnam Chamber of Commerce and Industry. (2019). *Doing Business in Vietnam*. Ho Chi Minh: PwC Vietnam.
- Rada, E. C., Bresciani, C., Girelli, E., & Ragazzi, M. (2016). Analysis and Measures to Improve Waste Management in Schools. *Sustainability*, 8(9), 840.
- Rakotomamonjy, S. N., Jones, J. P., Razafimanahaka, J. H., Ramamonjisoa, B., & Williams, S. J. (2014). The effects of environmental education on children's and parents' knowledge and attitudes towards lemurs in rural Madagascar. *Animal Conservation*, 18(2):157-166.

- Safari, A., & Hosseini, Z. (2016). The Effect of Workshop Training Method and Electronic Teaching Method on Mathematics Learning. *European Journal of Multidisciplinary Studies*, 3(1), 3(1):166-171.
- Schneider, P., Le, A. H., Wagner, J., Reichenbach, J., & Hebner, A. (2017). Solid Waste Management in Ho Chi Minh City, Vietnam: Moving towards a Circular Economy? *Sustainability*, 9(2):286-306.
- Sorrentino, M., Trajber, R., Mendonça, P., & Ferraro Jr, L. A. (2005). Environmental education as public policy. *Educação e Pesquisa*, 31(2):1517-9702.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and researchagenda. *Journal of Environmental Psychology*, 29(3):309–317.
- Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. (2013). *International handbook of Research on Environmental Education*. New York: The American Educational Research Association (AERA).
- Taniguchi, Y., & Yoshida, M. (2011). Public Involvement and Mobilization for Promoting 3R Initiative in Hanoi City - Lessons from 3R Initiative Project in Hanoi City 2006-2009 -. *the 8th Expert Meeting on Solid Waste Management in Asia and Pacific Islands (SWAPI)* (pp. 21-23). Tokyo: the 8th Expert Meeting on Solid Waste Management in Asia and Pacific Islands (SWAPI).
- The Ministry of Education. (2019). *Current Climate of ESD in Japan*. National Institute for Educational Policy Research .
- the Ministry of Education and Training. (2017). *CHƯƠNG TRÌNH GIÁO DỤC PHỔ THÔNG CHƯƠNG TRÌNH TỔNG THỂ*. Ha Noi: the Ministry of Education and Training Vietnam.
- The World Bank in Vietnam. (2019, October 18). *The World Bank Group*. Retrieved from The World Bank Group Web site: <https://www.worldbank.org/>
- TheWorldBank. (2013). *Energizing green cities in Southeast Asia : applying sustainable urban energy and emissions planning*. The World Bank.
- TheWorldEducationForum. (2015). *Viet Nam Education for All 2015 National Review*. Incheon, Republic of Korea: the United Nations Educational, Scientific and Cultural Organization.
- Thomas, W. I., & Znaniecki, F. (1918). *The polish peasant in EuropeE and America*. Boston: The Gorham press.
- Treagust, D. F., Amarant, A., Chandrasegaran, A. L., & Won, M. (2016). A case for enhancing environmental education programs in schools: Reflecting on primary school students' knowledge and attitudes. *International Journal of Environmental and Science Education*, 11(12), 5591-5612.
- Treagust, D. F., Amarant, A., Chandrasegaran, A. L., & Won, M. (2016). A Case for Enhancing Environmental Education Programs in Schools: Reflecting On Primary School Students' Knowledge and Attitudes . *International Journal of Environmental & Science Education*, 11(12):5591-5612.

- UNDP. (2018, June 26). *United Nations Development Programme*. Retrieved from UNDP Vietnam:
<https://www.vn.undp.org/content/vietnam/en/home/presscenter/articles/2018/vietnam-joins-hands-to-protect-ocean.html>
- UNESCO. (1975). *Intergovernmental Conference on Environmental Education: Final Report*. Stockholm: The United Nations Education, Scientific, and Cultural Organization .
- UNESCO. (1978). *Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage*. Washington: The United Nations Education, Scientific, and Cultural Organization.
- UNESCO. (1984). *Activities of the UNESCO-UNEP International Environmental Education Programme: 1975-1983*. Paris: The United Nations Education, Scientific, and Cultural Organization .
- UNESCO. (2005). *The 2005 convention on the Protection and Promotion of the Diversity of Cultural Expressions*. Paris: The United Nations Education, Scientific, and Cultural Organization .
- UNESCO. (2005). *UN Decade of Education for Sustainable Development 2005 - 2014 The DESD at a glance*. Illus: The United Nations Educational, Scientific and Cultural Organization.
- UNESCO, & UIS. (2018). *Quick Guide to Education Indicators for SDG 4*. Quebec: The United Nations Education, Scientific and Cultural Organization.
- UNESCO, & UNEP. (1975). *The Belgrade chapter: A Framework for Environmental Education*. Belgrade: The United Nations Education, Scientific, and Cultural Organization .
- UNESCO, & UNEP. (1977). *The Tbilisi Declaration*. Tbilisi: The United Nations Education, Scientific, and Cultural Organization .
- UNESCO. Director-General. (2014, 10). *UNESCO Education Strategy 2014-2021*. Paris, France.
- UNFPA. (2017). *Regional intervention action plan for Asia and the Pacific*. The United Nations Population fund.
- Varela-Losada, M., Vega-Marcote, P., Pérez-Rodríguez, U., & Álvarez-Lires, M. (2016). Going to action? A literature review on educational proposals in formal Environmental Education. *Environmental Education Research*, 22, 22(3):390-421.
- Vietnam News. (2019, 2 12). *Việt Nam takes action to reduce plastic waste*. Retrieved from Việt Nam News: <https://vietnamnews.vn>
- Villarroel, J. D., & Infante, G. (2014). Early understanding of the concept of living things: an examination of young children's drawings of plant life. *Journal of Biological Education*, 48(3):119-126.
- Watson, J. B. (1925). *Behaviorism*. People's Institute Publishing Company.
- Weinerta, F. E., & Helmke, A. (1998). The neglected role of individual differences in theoretical models of cognitive development. *Learning and Instruction*, 8(4):309-323.

- Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing Reliability and Stability in Panel Models. *Sociological Methodology*, 8:84-136.
- Wisconsin State Legislature. (2019, 11). *Wisconsin State Legislature*. Retrieved from legis.wisconsin.: https://docs.legis.wisconsin.gov/code/admin_code/pi/8/01/2/k
- Wisconsin State Legislature. (2019, 11). *Wisconsin State Legislature*. Retrieved from legis.wisconsin: https://docs.legis.wisconsin.gov/code/admin_code/pi/8/01/2/k/6/b
- Wood, K. C., Smith, H., & Grossnoklaus, D. (2011). *Piaget's Stages of Cognitive Development*. Saylor Academy.
- Yamasaki, H. (2016). *Teachers and Teacher Education in Japan*. Hiroshima: Hiroshima University.

Environmental Education Survey

Elementary students

Survey 1



We want to know what YOU think about environment.

This is NOT a test

There are NO wrong answers

YOUR answers are private

No one will be told how you answered

You do NOT have to answer any question if you do not want to, but we
hope you will answer as many questions as you can.

NAME	
CLASS	
SCHOOL	
SEXY	<input type="checkbox"/> Male <input type="checkbox"/> Female
DATE	... Year ... Month ... Day

Please help me answer the questions by following the request of the questions. Thank you.

1. Put a number from 1 to 4 beside each subject. Like (1), Normal (2), Don't like (3), Don't want to do (4)
 - ☐ Go to school
 - ☐ Watching movie
 - ☐ Using computer
 - ☐ Going out with family.
2. When you have nothing to do what would be your first choices to pass the time? Check three answers that you usually do.
 - ☐ Draw pictures, paint, make things with clay.
 - ☐ Go exploring on a bike.
 - ☐ Go on Face book
 - ☐ Go shopping
 - ☐ Go swimming.
 - ☐ Hang out with friends
 - ☐ Listen to music
 - ☐ Play a sport with friends. Which sport? _____
 - ☐ Play outdoor games
 - ☐ Play with games on a computer.
 - ☐ Read a book.
 - ☐ Something not on this list – please write it down. _____
 - ☐ Watch television.
 - ☐ Write
3. How many days/week do you use computer?
 - ☐ I didn't use computer
 - ☐ Less than 3 days
 - ☐ From 3 days to 6days
 - ☐ Every day (7days/week)
4. What do you do with your computer?
 - ☐ Playing the game
 - ☐ Reading book
 - ☐ Watching cartoon
 - ☐ Learning
 - ☐ Other

If you choose other, please write down the activities what you do.

-

-

5. How many days/week do you watch television?

☐ I didn't watch television

☐ Less than 3 days

☐ From 3 days to 6days

☐ Every day (7days/week)

6. What kind of television program do you usually watch?

☐ Cartoon

☐ Music program.

☐ Cooking program

☐ Sport program

☐ Other (

If you choose other, please write down the program what you usually watch.

-

-

7. Do you usually go out with your parents?

☐ No

☐ Sometimes

☐ Yes

8. Where do you go with your parent?

☐ Park

☐ Your grandparent house

☐ Amusement parks

☐ Other

If you choose other, please write down the activities what you usually do with your parents.

-

-

9. How many days/week do you go out to play with your family?

☐ I didn't go out with my parents

☐ Less than 3 days

☐ From 3 days to 6days

☐ Every day (7days/week)

10. Can you write your schedule that you did yesterday?

Time	Activity

Example: From 7:00 am to 11:00 I went to school

Time	Activity
7:00 – 11:00	I went to school
14:00 – 15:00	I played computer

11. What did you do on last summer vacation? Please write more than 3 activities.

-
-
-

12. What do you like to do in your summer vacation?

-
-
-

13. Do your parents teach you to save energy in your house?

☐ No

☐ Sometime

☐ Yes

If your answer is yes, please write what did you parents teach you?

-
-
-

14. Do your parents teach you to save water in your house?

- ☐ Yes
- ☐ Sometime
- ☐ No

If your answer is yes, please write what did you parents teach you?

-

-

-

15. How many hours/day do you use for your study (including tutor class and do homework at home)?

- ☐ Less than 6 hours
- ☐ From 6 to 8 hours
- ☐ From 8 to 10 hours
- ☐ More than 10 hours

16. How many hours/day do you use for your study in weekend?

- ☐ I didn't study in weekend
- ☐ Less than 4 hours
- ☐ From 4 to 6 hours
- ☐ From 6 to 8 hours
- ☐ More than 8 hours

17. Put a number from 1 to 4 beside each subject. very liked (1), Like (2), Normal (3), Don't like (4)

- ☐ Ethic
- ☐ Science
- ☐ Geography & History
- ☐ Technique

18. What method do you use to learn?

- ☐ Read book
- ☐ Listen teacher
- ☐ Remember guild book
- ☐ Real life
- ☐ Other

If you choose other, please write down the method that you usually use to learn.

-

-

19. What do you like best in your school?
-
-
-
20. In your opinion, is your school clean?
- ☐ No
- ☐ Sometimes
- ☐ Yes
21. Do you join to clean your class?
- ☐ No
- ☐ Sometimes
- ☐ Yes
22. How many times/month do you clean class?
- ... times/month
23. Where you usually throw the garbage in public area?
- ☐ Everywhere
- ☐ Dustbin
- ☐ Place where nobody can't see
24. Where you usually throw the garbage in school?
- ☐ In box of your table
- ☐ Dustbin
- ☐ In the class
- ☐ In the yard
25. Where you usually throw the garbage in house?
- ☐ Everywhere
- ☐ Dustbin
- ☐ In your room
26. Environment is:
- ☐ Water, air, soil, wind
- ☐ Animal and plant
- ☐ Resources (coal, oil . . .)
- ☐ Disaster
27. What is the main reason to make environmental pollution?
- ☐ Because of Human
- ☐ Because of animal
- ☐ I don't know

28. Do you know: What is the food waste?

☐ Yes

☐ No

29. Do you know where food residue from houses, restaurants and schools in Da Nang goes? Choose as many options as you want.

☐ Landfill

☐ Incineration

☐ Feeding pigs

☐ Feeding pet animals

☐ Making fertilizers

☐ I don't know

30. Please write 3 activities that you think you can do to protect environment:

-

-

-

31. Please check the answer which you think it is right. You can choose many answers.

What do you think which kind of waste can recycle?

☐ Paper (book, note book, newspaper)

☐ Plastic bag

☐ Can

☐ Glass

☐ Bottle

☐ Clothes

☐ All answers

32. At your house do you separate the garbage?

☐ Yes

☐ No

☐ I don't know



Thank you so much for your cooperation.

Environmental Education Survey

Elementary students 5 Grade

Survey 3



We want to know what YOU think about environment.

This is NOT a test

There are NO wrong answers

YOUR answers are private

No one will be told how you answered

You do NOT have to answer any question if you do not want to, but we hope you will answer as many questions as you can.

NAME	
CLASS	
SCHOOL	
SEXY	<input type="checkbox"/> Male <input type="checkbox"/> Female
DATE	... Year ... Month ... Day

Please help me answer the questions by following the request of the questions. Thank you.

I. Separation garbage questions:

1. This is dustbin in public area in Da Nang city. Please look at the picture and answer the question in below. You can choose many answers.



- a. What kind of waste you can throw in green area – Recyclable area?

- ☐ Can
☐ Bottle
☐ Food waste
☐ New paper
☐ Glass
☐ Plastic
☐ Other answer

-
-

- b. What kind of waste you can throw in red area – Not recyclable area?

- ☐ Can
☐ Bottle
☐ Food waste
☐ New paper

☐ Glass

☐ Plastic

☐ Other answer

-

-

2. Which is best answer to describe the organic waste?

☐ Flower, fruit, tea waste, food waste, leaf, vegetables, coffee waste.

☐ Fruit, tea waste, food waste, leaf, vegetables, coffee waste.

☐ Flower, fruit, leaf, vegetables, coffee waste.

☐ I don't know

3. Which is best answer to describe the non – organic waste?

☐ Plastic bag, bone, toy waste, tissue paper, old cloth, tree brand, seashell, coal, glass

☐ Plastic bag, tissue paper, old cloth, tree brand, seashell, coal, glass

☐ Plastic bag, bone, toy waste, tree brand, seashell, coal, glass

☐ I don't know

4. Which is best answer to describe the recycle or reuse waste?

☐ Can, bottle, recycle bag, news paper.

☐ Can, bottle, news paper.

☐ Can, recycle bag, news paper.

☐ I don't know

5. Did you see eco bag like pictures in below?



☐



☐

6. What is the eco bag?

Eco bag is:

☐ The bag can reuse many time

☐ The normal plastic bags

- ☐ The paper bags
 - ☐ I don't know
7. Do your family use eco bag when your family go to super market?
- ☐ Yes
 - ☐ Sometime
 - ☐ No
8. Do you know that plastic bag is difficult to decompose in the natural?
- ☐ Yes
 - ☐ No

II. Food waste questions:

9. Please see picture below and answer the question.



You know what kind of thing that the woman carry?

☐ Food waste collect from households and restaurants

☐ Water

☐ I don't know

☐ Other answer

-

-

10. Do you know that a large amount of food residue from houses and restraints are recycled for breeding pigs in Da Nang?

☐ Yes

☐ No

11. Which pork do you prefer to eat, and why?

☐ Pork from pigs fed with food residue

☐ Pork from pigs fed with processed pig-feed (crops and other ingredients)

Please fill in the reason for the above choice.

-

-

12. Which do you think best to treat food residue. Please choose one.

☐ Recycle for producing fertilizers

☐ Recycle for breeding pigs

☐ Use for producing energy (Gas, electricity)

☐ Dump in the landfill site

13. Did you participate in any environment program from 5/2014 until now?

☐ Yes

☐ No

If answer is yes, please follow questions 14, 15. If answer is no, please answer question 16.

14. Please write down the name of environmental activities that you participated in this time?

-

-

-

15. Can you write some information that you think interesting about solid waste management when you attend environmental activities before?

-

-

-

16. Can you write some information that you think interesting about solid waste management when you attend our activities?

-

-

-

Appendix C: Questionnaire survey for 6-month workshop EE

Student name:

Gender:

Class:

Please chose your answers

Questions	Wrong	Maybe Wrong	Not sure	Maybe Right	Right
1. To save water, I would be willing to use less water when I bathe.					
2. I would not be willing to save energy by using the air conditioning less.					
3. To save energy, I would be willing to turn off the light when I go out.					
4. I am not afraid about the effects of pollution on my family					
5. I do not worry about solid waste problems.					
6. It is important for me to follow the rules of society.					
7. My family members always reuse old clothes.					
8. My family members always save energy.					
9. My family members always use eco-bags to reduce garbage.					
10. Separation of waste is easy for me.					
11. It is easy to carry the eco-bags when I go shopping.					
12. I do not like to use eco-bags when I go shopping.					
13. I do not like to wear old clothes.					
14. I do not like to eat pork from pigs that were fed by food waste.					
15. It is easy to donate food waste to farmers to feed pigs					
16. I do not like to use produce that is made from recycled materials.					
17. I like to get nylon bags when I go shopping.					
18. I would be willing to use eco-bags instead of nylon-bags to save the environment.					
19. I would not be willing to separate my family's waste for recycling.					
20. I would be willing to give food waste to pig farms to reduce waste.					
21. I would not be willing to reuse old clothes in my house to protect the environment					
22. I would be willing to explain to my parents the importance of reducing waste.					
23. I always use eco-bags instead of nylon bags to save the environment.					
24. I never separate my family's waste.					
25. I always give food waste to pig farms to reduce waste.					
26. I never reuse old clothes in my house.					

Please chose your answers

27. Besides at school, have you ever studied about the separation of waste in the household?	Wrong	Not Sure	Right
28. Separating waste is my parents' responsibility.			
29. Waste separation is the government's responsibility.			
30. I will do my best to clean my house.			
31. I will try my best to reduce the amount of waste.			

Please circle your answers:

32. Compared to other paper, recycled paper

- (a) Takes more water to make
- (b) Takes less energy to make
- (c) Is more expensive to buy
- (d) Is harder to write on
- (e) Produces more pollution

33. In Da Nang where does most of the waste go after it is collected by waste trucks

- (f) To an aquifer where it is buried
- (g) It is dumped into ocean
- (h) It is recycled to make plastic
- (i) To a Khanh Son landfill
- (j) To farmers who use it as fertilizer

34. Items that cannot be recycled and used again are:

- (a) Newspapers
- (b) Cans
- (c) Bottles
- (d) Glasses
- (e) Cigarette wastes

35. What is an eco-bag?

- (f) A nylon bag that can be used only once
- (g) A paper bag that can be used only once
- (h) A cloth bag that can be used only once
- (i) A plastic bag that can be used only once
- (j) A plastic bag or cloth bag that can be reused many times

36. What do you think can be done with paper that is printed on one side?

- (a) Throw it in the dust bin
- (b) Use the other side before recycling it
- (c) Recycle it
- (d) Do not use it
- (e) Do not care

37. What does 3Rs mean?

- (f) Recycle, reuse and reduce waste

- (g) Throw waste in the rubbish bin
 - (h) Recycle, reuse and separation of waste
 - (i) Reuse and reduce waste
 - (j) Protect the environment
38. Why do we need to recycle?
- (f) To reduce the amount of waste that goes to a landfill
 - (g) To earn money
 - (h) For fun
 - (i) For school donations
 - (j) To reduce space
39. The main reason for using eco-bags is:
- (f) To recycle waste
 - (g) For their ease of use
 - (h) To reduce the amount of nylon-bags, protect environment
 - (i) For fashion
 - (j) To save money when we shopping
40. What should you NOT do when you grow out of clothes?
- (f) Throw them out and buy new clothes
 - (g) Pass them on to a sibling or friend
 - (h) Pass them on to a younger family member
 - (i) Donate them to a charity
 - (j) Use them to clean your house
41. What should you NOT do with food waste?
- (a) Throw it away
 - (b) Use it to feed pigs
 - (c) Make fertilizer
 - (d) Make biogas
 - (e) Reduce food waste

Appendix D: Questionnaire survey for 14 months after 6-month EE

Student name:

Gender:

Class:

Please chose your answers

Questions	Wrong	Maybe Wrong	Not sure	Maybe Right	Right
To save water, I would be willing to use less water when I bathe.					
To save energy, I would be willing to turn off the light when I go out.					
Separation of waste is easy for me.					
It is easy to carry the eco-bags when I go shopping.					
I would be willing to use eco-bags instead of nylon-bags to save the environment.					
I would not be willing to separate my family's waste for recycling.					
I would be willing to give food waste to pig farms to reduce waste.					
I would be willing to explain to my parents the importance of reducing waste.					

Please circle your answers:

1. In Da Nang where does most of the waste go after it is collected by waste trucks

To an aquifer where it is buried

It is dumped into ocean

It is recycled to make plastic

To a Khanh Son landfill

To farmers who use it as fertilizer

2. What is an eco-bag?

A nylon bag that can be used only once

A paper bag that can be used only once

A cloth bag that can be used only once

A plastic bag that can be used only once

A plastic bag or cloth bag that can be reused many times

3. What does 3Rs mean?

Recycle, reuse and reduce waste

Throw waste in the rubbish bin

Recycle, reuse and separation of waste

Reuse and reduce waste

Protect the environment

4. Why do we need to recycle?

To reduce the amount of waste that goes to a landfill

To earn money

For fun

For school donations

To reduce space

5. The main reason for using eco-bags is:

To recycle waste

For their ease of use

To reduce the amount of nylon-bags, protect environment

For fashion

To save money when we shopping

6. What should you NOT do when you grow out of clothes?

Throw them out and buy new clothes

Pass them on to a sibling or friend

Pass them on to a younger family member

Donate them to a charity

Use them to clean your house

Could you please tell me what you remember about the EE that you engage on last year?

How frequently did you do the following activity during the past one year?

Questions	Always	Very often	Sometimes	Rarely	never
7. Did you save water when you take a bathe?					
8. Did you turn off light when you go out to save energy?					
9. Did you separate waste in your home?					
10. Did you carry eco-bags when you go shopping?					
11. Did you or your family give food waste to pig farms?					
12. Did you explain your parents about the importance of reducing waste?					

13. From March 2017 until now, did you attend any environmental activities?

☐ Yes

☐ No

14. If your answer is “YES”, please write name of environment activities that you engage

15. How frequently did you do the following activity during the past one year?

Appendix E: Pictures of one-time EE from 2014-2015



Student answered the solid waste management questions



Showed blackboard design that used to teach students




Student answered questionnaire survey



Student joined game activities

GIẢM THIỂU RÁC




Thành Phố Đà Nẵng
mỗi ngày thải ra
573 tấn rác là một
người bằng 0,7kg rác.
79.55% là rác hữu cơ.
Còn rác vô cơ là 11.50%
Người dân hỏi với
CBĐ rằng: "Làm
thế nào để giảm thiểu rác?"
Muốn giảm thiểu rác thải chúng
ta phải: Không vứt rác bừa bãi, dùng
túi sinh thái thay cho túi nylon,
áp dụng công thức 3R.

Theo Tin tức

RÁC VÔ CƠ HỮU CƠ


Môi trường đang
trong tình trạng
ô nhiễm do con
người xả rác
bừa bãi và các
nhà máy xả thải
ra quá nhiều khí
CO₂. Để môi
trường xanh sạch
đẹp chúng
ta cần phân loại
rác đúng, không
xả rác bừa bãi,
đi tiểu, đi tiêu
đúng quy định và
tuyên truyền cho
mọi người.

RÁC HỮU CƠ



HOA
TRÁI CÂY
RÀU CẢI
VƯỜI
CÀ PHÊ
THỨC ĂN THỎ

RÁC VÔ CƠ TÁI CHẾ



VỎ HỘP
CHAI
Túi nhựa
giấy báo
chai nhựa
vải sợi
Thuốc lá
Quần áo cũ
XƯƠNG
THAN
Vỏ đồ, Hòn
nylon

Giảm Thiểu Rác Thải

Ảnh hưởng tác hại của việc xả rác thải ra môi trường.

- 1). Ô nhiễm môi trường
- 2). Gây ra bệnh tật, dễ gây bệnh cho mọi người

Cách giảm thiểu rác thải

- 1). Giảm ăn thừa cho heo ăn
- 2). Tái chế rác
- 3). Sử dụng lại các sản phẩm có cùng một một mục tích tái tạo.
- Các sử dụng





BẢO VỆ môi trường giảm thiểu rác thải

Kính thưa quý vị, chúng ta sẽ bắt đầu một cuộc sống mới môi trường mới! Các bạn hãy không xả rác, không vứt rác gần nguồn nước. Dự tính đến năm 2020 rác thải sinh hoạt sẽ ngày càng tăng, chúng ta cần phải giảm lượng rác thải bằng những cách sau: phân loại rác, tái chế, giảm thiểu rác thải. Đó là cách để...

BING BANG rác vô cơ, rác hữu cơ

rác vô cơ (k.o)

rau củ, nhóm em xin trình bày về rác vô cơ và rác hữu cơ. Rác vô cơ gồm có 2 loại là: tái chế được: túi nhựa, chai nhựa, vỏ hộp, chai, giấy báo, rác rưởi... không tái chế được: vỏ hộp, túi nilon, đồ chơi, giày dép... còn rác hữu cơ là loại thức ăn thừa, trái cây, cỏ khô...

rác vô cơ (k.o)

rác hữu cơ