

Chapter 4

Leadership Development for Sustainable Urban Environmental Management: Cases in Thailand

Tomomi Hoshiko and Tomohiro Akiyama

Abstract This chapter explores future challenges to improve the design and implementation of the Thailand Unit by examining two cases of the unit conducted in 2009 and 2011. The unit covers two important issues of urban environmental management: Solid waste management and urban water use and management. Development, implementation, results and review processes of the unit are shown by comparing both cases. To examine educational effects of the unit in terms of its academic contents, group work results are shown. To improve the unit design and implementation, questionnaire survey results for the involved faculty members are shown, where the strengths and weakness are clearly indicated. To review the effects of the unit participation on leadership development in individual students, their feedback comments are shown and serve as proof of the unit's achievements.

Keywords Fieldwork • Group work • Leadership development • Solid waste • Thailand • Urban environmental management • Urban water

T. Hoshiko (✉)

Asian Program for Incubation of Environmental Leaders (APIEL),
Department of Urban Engineering, Graduate School of Engineering, The University of Tokyo,
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan
e-mail: hoshiko@env.t.u-tokyo.ac.jp

T. Akiyama

Graduate Program in Sustainability Science, Graduate School of Frontier Sciences,
The University of Tokyo, Environmental Studies Building 334, 5-1-5 Kashiwanoha,
Kashiwa, Chiba 277-8563, Japan
e-mail: akiyama@k.u-tokyo.ac.jp

4.1 Introduction

Asian developing countries have recently been facing serious urban environmental problems. This is the case especially with large cities undergoing rapid development. Thailand is not an exception and consequently, urban environmental management is a highly important issue. The Thailand Unit is established to foster students' environmental leadership by examining sustainable urban environmental management. The unit dealt with three important issues of urban environmental management: (1) solid waste management (SWM), (2) urban water use and management, and (3) urban flood management in 2009, 2011 and 2012, respectively.¹ Today, disaster-related issues are also becoming increasingly important for sustainability and environmental leadership projects. In fact, the unit held in 2012 focused on the flooding in Bangkok in 2011, which was introduced in the earlier Sect. 2.3.3.

This chapter explores future challenges to improve the design and implementation of the Thailand Unit by examining two cases of the unit conducted in 2009 and 2011 in collaboration with Asian Institute of Technology (AIT) and Kasetsart University (KU). The remainder of this chapter is organized to show how the two cases of the unit were developed, how the programs were implemented year by year, and how the educational effects were examined, as well as review of environmental leadership development in students.

4.2 Development of the Thailand Unit

In this section, background of the unit themes and characteristics of the unit design are described. We compared two different cases of the unit focusing on the core concepts, program content development and educational methods.

4.2.1 Themes of the Unit

The purpose of the unit was to develop in students, as future environmental leaders, a diverse, balanced and integrated understanding of environmental issues. The unit was designed to provide students with holistic and multifaceted information on the unit theme through a comprehensive series of lectures, fieldwork to experience real-world local environmental problems and intensive group discussion which encourages students to share different views, practice consensus building and improve their communication skills. By doing so, the unit tried to enable students to broaden their perspectives and develop on-the-ground competency to identify and resolve environmental problems.

¹In 2010, implementation of the field exercise unit was cancelled and postponed until 2011 due to concern over political unrest in Thailand.

Backgrounds of the two unit themes of urban environmental management are as follows: Management of solid waste involves several direct and indirect issues. A complex problem by nature, SWM takes priority in the agenda of programs on environmental education. While theories on SWM are taught at different levels, a course offering a systemic view is uncommon [1]. The first field exercise “Sustainable Solid Waste Management in Asian Developing Countries (2009)” was structured with the aim of providing hands-on experience in solving real-world waste management problems. A field case in Nonthaburi Province was the highlight of the program. Nonthaburi Province is adjacent to Bangkok and its urban population has been growing accompanying the economic growth and expansion of transportation infrastructure in Bangkok. Although the solid waste has not been collected from Bangkok, the amount of waste has been increasing in the province and there are several environmental problems such as an inefficient system of waste collection, leachate from the landfill, etc.

The second field exercise “Sustainable Urban Water Use and Management in Bangkok (2011)” was structured within the context of a tropical region and the multi-sector dimensions of the issues. Water resource management is a critical issue under both regional and local conditions and especially in tropical regions, it is vulnerable and access to safe water is limited. The focus was centered on Bangkok, where several complex management problems and challenges exist, such as increasing demand of water, an inefficient supply system, and administrative as well as social aspects including economic feasibility of expansion or upgrading of the infrastructure and management system. Both themes were approached by a blend of components of theory, practice, fieldwork and discussion, which is the unique style of the APIEL field exercise.

4.2.2 Concepts and Group Work Task of the Unit

To develop the unit (program), faculty members shared ideas about educational approaches and possible contents and agreed on the following concept in 2009: To develop leadership in students, the most important is for the students to “find” or “identify” issues and problems in the field through discussion among themselves. Namely, we took a “project finding” approach from a real-world experience. Thus, we decided to first bring students to field sites after introductory lectures on basic aspects of the theme, and then lead them in group discussions on the issues actually witnessed in the field. Then there were more lectures and related fieldwork that helped students set and analyze specific tasks of their group work projects, followed by intensive group work to prepare the final presentations.

In 2011, emphasis was made on proposal development for sustainable urban water use and management as well as sustainability indicator analysis to help develop the proposal plan using a scientific approach. Sufficient information on the current important issues of urban water use and management were provided through lectures and field activities. Based on that, students set a future vision and are required to search an effective approach to realize the vision. Namely, we took an “approach

Table 4.1 Group work task

<i>(a) Year 2009</i>	
Approach	Project finding
Instruction	“Based on your own interests, and using the preliminary assignments, lectures and fieldwork during the field program, find a problem to be solved and set concrete objectives for the group work theme. Each group has to frame the work structure to be accomplished by the end of the field exercise, then present conclusions, solutions, and proposals.”
<i>(b) Year 2011</i>	
Approach	Approach finding
Instruction	<ol style="list-style-type: none"> 1. Invent sustainability indicators for sustainable urban water use and management 2. Apply the indicators to measure and evaluate the current situation in Bangkok 3. Find problems in the current situation using the evaluations 4. Based on the analysis, come up with solutions for improvement and develop plans for sustainable urban water use and management for the year 2030 in Bangkok

finding” strategy during the proposal on a development plan for 2030. We expected students to have a clearer image to act as environmental leaders in their actual future.

For group work, students were divided into three groups looking for a good balance of the three universities to share their different backgrounds. In line with the project finding approach in 2009, they are instructed to set their own tasks following instructions as shown in Table 4.1a. They are also advised that it is important to frame the group projects with multiple stakeholders and multi-disciplinary solutions in minds.

In 2011, based on the approach finding strategy, students are instructed to develop future plans with scientific and practical approaches that they must find by themselves. Table 4.1b shows the instruction steps. Starting with sustainability indicator analysis to evaluate the current situation of Bangkok, the target year of the proposal plan was set at 2030, a time when we expect the students to be actively contributing to the society as environmental leaders. The results of the group work will be shown in the following results Sect. 4.3.1.

In order to obtain achievements from the unit in terms of academic contents, it was also considered valuable for the students to experience an international conference in the region to present their group work outcomes. In the initial phase of APIEL’s educational program development, the Department of Urban Engineering (UE) of the University of Tokyo (UT) had a clear idea that it is important for our field-oriented education to effectively use existing academic networks and resources in Southeast Asia. These networks had been already established when organizing the International Symposium on Southeast Asian Water Environment (SEAWE), which has been successfully run by the department every year since 2003. Therefore, the unit programs were developed to be held in conjunction with the SEAWE.

4.2.3 Content Development of the Unit

Figure 4.1 shows the program contents developed for the unit 2009. The lecture part was arranged to cover components of technology, management, and policy, as well as introduction/fundamentals and looking ahead (at first and fourth stages in Fig. 4.1). We also invited outside experts and policymakers as lecturers. This structure was prepared to cover important issues of solid waste management in a multi-dimensional and comprehensive way.

Field activities in 2009 were arranged at Sainoi landfill site in Nonthaburi, a waste transfer station, a composting plant, and a medical waste incinerator in Bangkok, an E-waste recycling center at Suan Kaew temple, and a used electric appliance trading market. At the Sainoi landfill site, for example, students can learn about a leachate problem which pollutes surrounding water environments, greenhouse gas (GHG) emission issue and its possible recovery, appropriate application of landfill technology, problems around waste-picker and informal sector involvement, etc. Seeing the real-world local problems, some of which should be solved in a local governance context, and considering that some are influenced by a regional interaction, while others should be considered in a global context, student groups come up with their own projects to undertake.

In 2011, in order to prepare comprehensive information on the program theme, we drew a conceptual framework of the issues of urban water use and management as shown in Fig. 4.2. Important aspects were considered to be water quantity, quality, governance and technology. For the quantity aspect, the introductory lecture covered interactive water demand from three sectors—urban, industry and agriculture, and a field visit to an irrigation project also covered an agricultural water issue. Promotion of 3Rs (reduce, reuse and recycle) for water resources was introduced in a lecture and also a field activity was arranged to observe a wastewater reuse application in a real case. Regarding the quality aspect, field survey on Chao Phraya River water and canal water quality sampling was planned. As for the governance aspect, Thai policies and administration were covered in lectures by local and national government officers, and international governance issues were also covered in another lecture within the tropical region context. Technology aspect was also covered by lectures and various advanced technologies from cases of Tokyo and Singapore were introduced. In addition, climate change impact issues and NGO involvement in water pollution control and economic instruments were incorporated for the analysis of future perspectives.

4.2.4 Educational Methods

Methods of the analysis of educational effects, unit design and leadership development are as follows:

1. In order to examine the educational effects of the field exercise unit in terms of its academic contents, topics of students' group work projects were collected

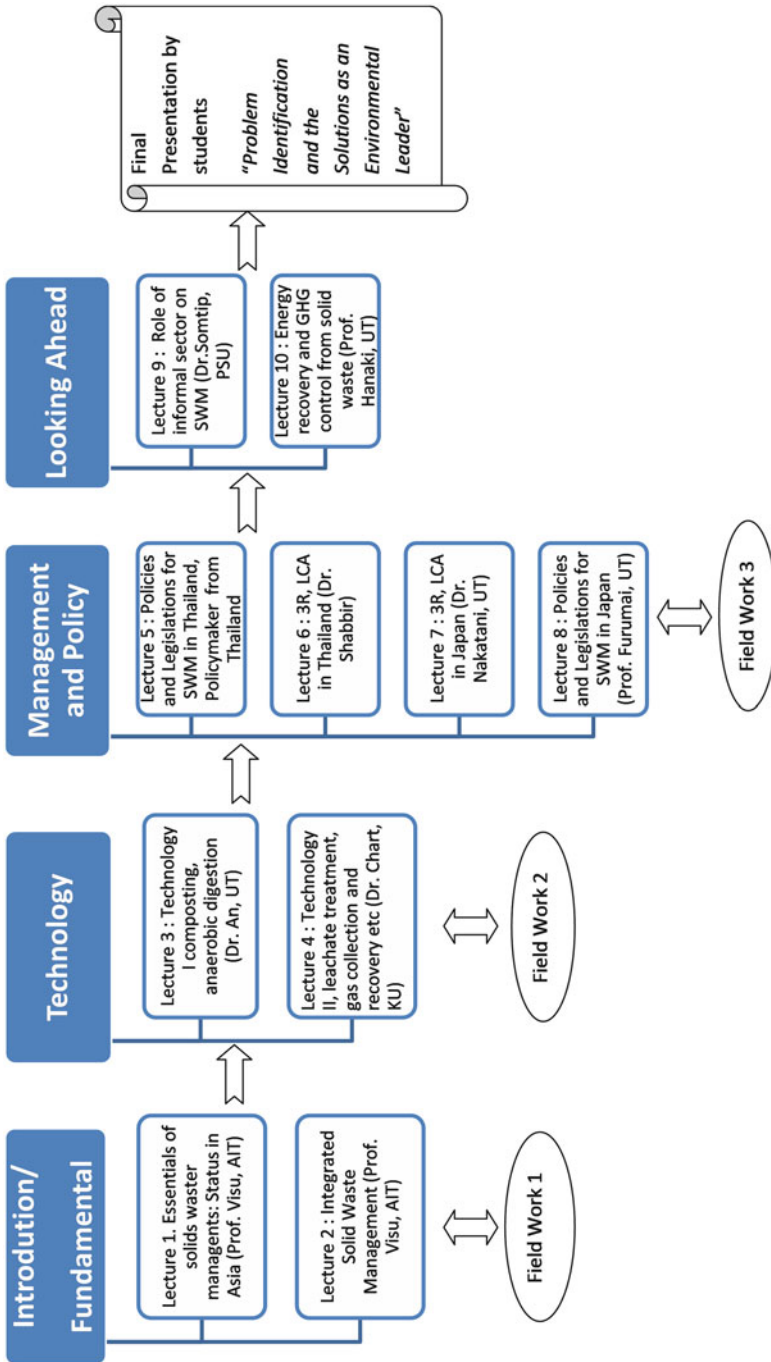
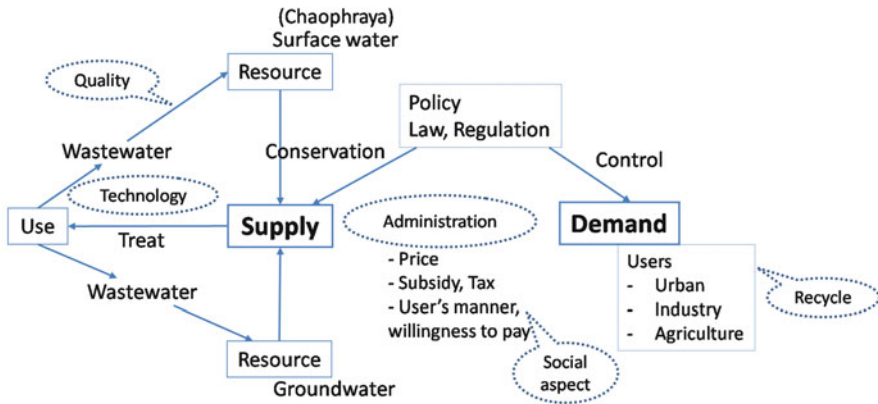


Fig. 4.1 Structure of the lectures of Thailand Unit in 2009



Discussion

<p>Thailand case</p> <ul style="list-style-type: none"> - Country aspect - Seasonality (dry, wet) - Public acceptance of reclaimed water, etc. 	<p>Tropical region case</p> <ul style="list-style-type: none"> - Climate change impact (water resource vulnerability, CO₂/energy), etc. 	<p>Future scenarios</p> <ul style="list-style-type: none"> - Water demand - Population - Economy - Hydrology, etc. 	<p>«Analysis Tool»</p> <ul style="list-style-type: none"> - Water mass balance - CO₂/Energy
--	--	---	--

Fig. 4.2 Conceptual framework of the issues of urban water use and management

from the two cases in 2009 and 2011, which employed two different approaches to the group work.

2. In order to improve the unit design and implementation, questionnaire surveys of involved faculty members were conducted to ask strengths and weaknesses.
3. Effects of the unit participation on leadership development in students were examined through feedback comments from the students themselves.

4.3 Implementation of the Thailand Unit

Factual information on the unit implementation is presented in this subsection, including participants’ background as well as the field program schedules.

4.3.1 Participants

Participants of the unit in 2009 were six students from UT, six AIT students, and five KU students. In 2011, five UT students, five AIT students, and five KU students participated. Their genders and nationality are shown in Table 4.2.

Academic backgrounds of participants were different in 2009 and 2011. In 2009, the students from Thai counterpart were only from the discipline of environmental engineering. To further diversify the group, in 2011; Thai local counterparts expanded their student backgrounds to come from all the disciplines in AIT and

Table 4.2 Student participants

	UT	AIT	KU
<i>(a) Year 2009</i>			
Number of participants	6	6	5
Gender	4 male, 2 female	3 male, 3 female	1 male, 4 female
Nationality	4 Japanese, 1 Filipino, 1 Bolivian	2 Pakistani, 2 Nepali, 1 German, 1 Thai	5 Thai
<i>(b) Year 2011</i>			
Number of participants	5	5	5
Gender	4 male, 1 female	2 male, 3 female	2 male, 3 female
Nationality	1 Japanese, 2 Chinese, 1 Indian, 1 Nepali	1 Chinese, 1 Nepali, 1 American, 1 Thai, 1 Sri Lankan	5 Thai

from other departments in addition to the Department of Environmental Engineering at KU, which was actually effective in the process of the proposal development in the group work from wider views.

4.3.2 Program Schedule of the Unit

4.3.2.1 Thailand Unit 2009

In 2009, prior to the field program, preliminary assignments were given to the students as follows: a literature review and an exercise on lifecycle assessment (LCA) of solid waste management to learn an analytical tool. One group actually applied this tool for their group project based on this preliminary assignment.

Figure 4.3 shows the program schedule in the field of the Thailand Unit in 2009. The program contained ten lectures, three classroom exercises, four fieldwork trips—Fig. 4.4 shows scenes of the field activities—and group work at the students' initiative almost every day, followed by the symposium and presentations. This unit was held in conjunction with the 7th SEAWA, October 28–30, 2009, at AIT, where student posters were presented on the outcomes of the field exercise. After the field program, summary reports were submitted and wrap-up presentations were given at UT.

4.3.2.2 Thailand Unit 2011

In 2011, prior to the field program, students were given preliminary assignments as follows: a literature review and proposal development exercise for water problems in Asian countries.

The program schedule in the field of the Thailand Unit in 2011 is shown in Fig. 4.5. It included eight lectures, two classroom exercises, and two full days of

Date	Venue	Morning 9:00-10:30	Morning 10:50-12:20	Afternoon 13:30-15:00	Afternoon 15:20-16:50	Evening	
1	21-Oct KU					Orientation	
2	22-Oct Thu KU	Lecture 1: Fundamentals	Exercise 1: Case work	Fieldwork 1: SWM in Bangkok		Group work	
3	23-Oct Fri AIT	Lecture 2: Fundamentals	Exercise 2: Case work	Fieldwork 2: Sainoi landfill site in Nonthaburi		Group work	
4	24-Oct Sat KU	Lecture 3: Technology	Lecture 4 : Technology	Lecture 5 : Management and Policy - Thailand	Group Work : Setting the theme and framing for the group work	Fieldwork 3: Used electronic appliance trading market	
5	25-Oct						
6	26-Oct Mon KU	Lecture 6: LCA	Lecture 7 : LCA	Exercise 3: LCA	Fieldwork 4 : E-waste recycling activities (Wat Suan Kaew)	Group work	
7	27-Oct Tue KU	Lecture 8: Management and Policy - Japan	Group work: Interim progress report	Lecture 9: Role of informal sector	Lecture 10: Global - Energy recovery and GHG control	Group work	
SEAWE Symposium							
8	28-Oct Wed AIT	Excursion by the Symposium					Group work
9	29-Oct Thu AIT	Opening ceremony	10:30-12:30 APIEL session	Attendance at the symposium sessions		Group work	
10	30-Oct Fri AIT	Attendance at the symposium sessions		13:00-14:30 Poster presentation	16:30-18:00 <APIEL Internal WS> Student final presentation & Closing	UT students go to the airport	

Fig. 4.3 Program schedule in the field in 2009. Yellow, blue, green and orange colors indicate time slots for the lecture, classroom exercise, fieldwork and group work, respectively



Fig. 4.4 Scenes of field activities in 2009. (a) Interview survey at the recycling market. (b) Waste transfer station. (c) Leachate test at the Sainoi landfill site. (d) Sainoi landfill site

fieldwork and group work at the students' initiative almost every day. Figure 4.6 shows scenes of group work and on-the-field activities. Since the symposium presentation on the group work outcomes was separate from the field program schedule this time, the schedule was less packed than that in 2009, and we were able to give the students more time for discussion. After the program in the field, summary reports were submitted and wrap-up presentations were conducted at UT. Afterward, the outcomes of the group work were presented as posters in the 9th SEAWE held in Bangkok on December 1–3, 2011.

4.4 Results and Reviews of the Thailand Unit

4.4.1 Group Work Results

To examine the educational effects of the unit programs in terms of their academic contents, the group work results are presented in this subsection. Details are summarized in Table 4.3 for the case in 2009 and in Table 4.4 for the case in 2011.

Date	Venue	Morning 9:00-10:30	Morning 10:50-12:20	Afternoon 13:30-15:00	Afternoon 15:20-16:50	Evening	
0	18-Aug AIT	UT students arrive at the BKK airport and move to AITCC					
1	19-Aug Fri AIT	Opening & Introduction	Lecture 1: Wastewater reuse: Urban, agriculture and industry sector interactions	Lecture 2: Challenge to sustainable urban water use in Tokyo	Exercise 1: Case study	Gathering event at AITCC	
2	20-Aug Sat AIT	Exercise 2: HW presentation, Brainstorming session	Lecture 3: Environmental leadership				
3	21-Aug AIT						
4	22-Aug Mon AIT	Group Work	Lecture 4: Social study on water governance in Thailand and international relations	Lecture 5: Perspectives on NGO involvement in water pollution control and economic instruments	Lecture 6: Singapore case on urban and industrial wastewater reuse	Group work	
5	23-Aug Tue Field	Fieldwork 1: Lecture at BMA, Wastewater reuse application, Rattanakosin WWTP, Water quality sampling at Chao Phraya river and canals					Group work
6	24-Aug Wed AIT	Lecture 7: Integrated Water Environment Management in Thailand		Lecture 8: Water reuse technology	Group work : Interim progress report	Group work	
7	25-Aug Thu Field	Fieldwork 2: Lecture at JICA, Irrigation projects, Wastewater reuse in agriculture					Group work
8	26-Aug Fri AIT	Group work					Group work
9	27-Aug Sat AIT	Final presentation	Closing Ceremony				
30-Aug		UT students return to Tokyo					

Fig. 4.5 Program schedule in the field in 2011. Yellow, blue, green and orange colors indicate time slots for the lecture, classroom exercise, fieldwork and group work, respectively



Fig. 4.6 Scenes of field activities and group work in 2011. (a) Water sampling of Chao Phraya River. (b) Brainstorming session. (c) Agricultural field visit. (d) Water quality measurement of Chao Phraya River

4.4.1.1 Thailand Unit 2009

In 2009, group work was conducted based on the project finding approach, which involved intensive discussions on topic finding and consensus building under strict time limits. Because of this approach, more than one student commented afterward that consensus building at the initial phase was one of the most difficult and time-consuming parts, since each person had different ideas and would not easily be persuaded to change them. There were also language barriers, and students encountered different attitudes, dependent on culture and communication style. One student also said that she understood that with limited resources the real situation and problems so complex that it becomes difficult to prioritize the problems. From the presented results, however, it was pointed out that the given group work tasks were sufficiently met and solutions for the addressed problems were clearly proposed. Thus, consensus was made, language barriers were not fatal, and prioritization of the problems was achieved. Furthermore, it was revealed that field visits with support of comprehensive lectures were very good materials, in combination with the project finding approach, to learn practical issues and to do training on problem solving in the context of a team.

These results were presented in the 7th SEAW. It was incorporated at the end of the field program schedule, which was the cause of strict time limits for the students to complete their projects. The presentations were successfully done through

Table 4.3 Group work results (2009)

Group 1	Title: Sustainable E-waste management in developing countries—economic benefits and health risks [2]
----------------	---

Abstract: Focusing on the health issue of solid waste, proper E-waste management systems in developing countries were discussed. The objectives were to propose a safe E-waste recycling system at the local level with lower risk for workers and the environment, especially using case studies in China and Thailand, and to show their advantages and disadvantages. Health risks and environmental impact in China and successful E-waste management at the Suan Kaew temple in Nonthaburi were reviewed. E-waste recycling creates job opportunities in developing countries, saves resources, and at the same time gives the underprivileged access to electric and electronic equipment. However, most people there work under poor conditions due to a lack of awareness and understanding of occupational health regulations. The institutionalization of E-waste management, including training on health risks and guidelines for adequate working conditions, can help overcome the negative impact.

Group 2	Title: Sustainable vision for SWM in Bangkok [3]
----------------	---

Abstract: Through the field visits, problems were identified in improper waste management in each unit operation resulting unsanitary conditions and low quality of life (QOL). The objective was to develop a vision for sustainable SWM aiming at overall improvement of the whole management system in Bangkok through intensive discussion on how to achieve the vision at this transition stage—from the current situation towards the goal. According to the analysis of waste flow in Bangkok, it turned out that there is strong potential to improve all the steps of SWM. Big problems include an ineffective infrastructure and lack of awareness and knowledge by workers and householders. Cooperation with the public and private sectors is also needed. Furthermore, the “informal sector” has great potential to do recycling in more effective ways as a business. We know that a developing country can’t change quickly and that this requires step-by-step improvements. So, we will rethink the current system, improve existing facilities, try to reorganize the whole system and arrive at a future vision. Involving local people makes the system more practical in real society. We have to consider not only the management and technical problems but also the social systems. This should be the most effective way for proper, integrated SWM.

Group 3	Title: GHG emission reduction potential in a solid waste disposal site—a case study of the Sainoi landfill [4]
----------------	---

Abstract: Reducing GHG (greenhouse gas) emissions from the landfill was the main challenge. The objectives were to estimate baseline GHG emissions from the landfill site and to estimate emission reduction by considering three scenarios: flaring, generating electricity from captured biogas, and incineration using a LCA approach. The findings were that CH₄ accounts for 84% of all of the GHG emissions. Recovery of CH₄ would have a large effect on GHG reduction (75%). Therefore, methane gas collection is an important factor [technique]. CH₄ flaring would reduce GHG emissions by 22%. The GHG emission potential for electricity generation in Thailand is larger than Japan. Therefore Thailand has more incentive to use landfill gas to generate electricity compared with Japan. Incineration can reduce up to 75% of GHG emissions. If incineration is introduced, it emits a greater amount of N₂O, so technology for reducing N₂O emissions is also important. If we used a factor in Thailand especially for CH₄ emissions from landfills, the result would be altered. In such a case, incentives for introducing CH₄ collection or incineration systems would be large. Based on the LCA analysis results, a scenario for the recovery and use of landfill gas for generating electricity had the largest emission reduction potential.

Table 4.4 Group work results (2011)

Group 1 Title: A framework for analysis of wastewater management system in Bangkok metropolitan area using sustainability indicators [5]

Abstract: In order to deal with wastewater, safeguard public health, and protect the natural environment in a sustainable way, a framework for analysis of the management system using sustainability indicators is needed to evaluate and improve the current system. The wastewater management system mainly includes wastewater collection and treatment. Sustainability indicators were used to consider the environmental, economic and social factors—employing the Drivers–Pressure–State–Impact–Response (DPSIR) methodology—for the seven existing wastewater treatment plants and the entire wastewater management system in Bangkok. Among the three factors (above), only the investment item in the economic factors was positive. The other items were evaluated as negative and far from satisfactory for sustainable operation. The current bad water quality is also threatening public health and natural sustainability. Finding problems is easier than solving them. Both Bangkok’s government and its citizens face big challenges: How to improve people’s awareness to change their own lifestyle; how to sustain and manage the wastewater treatment plants; how to design treated water reuse plans; how to improve treatment technology with less energy (less money); how to popularize and deepen sustainable education; and how to create more job opportunities and improve personal incomes together with the increasing need for higher living standards and the needs of the surrounding environment.

Group 2 Title: Challenges and opportunities for achieving sustainable urban water use and management in Bangkok 2030: proposal for sustainability indicators [6]

Abstract: The goal is to define sustainability indicators for urban water use. Managing the quantification of that sustainability using multidimensional indicators is a complicated issue. In Bangkok, annual water demand is growing at 8 %. At the same time, the quantity of wastewater has been increasing at a much faster rate. Currently only about 50 % (at a maximum) of the total wastewater is treated in Bangkok. As well, there are other problems that urgently require improvement, such as a fresh water shortage, and flooding and deterioration of water quality in the dry season. Not only technical issues but also socio-cultural issues must be considered in greater detail. Public acceptance of reusing reclaimed water is a major concern, no matter how good the quality. Effective communication among all the stakeholders—mainly from the government, public, industrial, and economic sectors—is crucial in setting up sustainable urban water use and management. Based on a review of these current problems, the following suggestions were made: a commitment at the policy level for sustainable urban water use and management, improvements in wastewater collection, promotion of energy and water-saving technologies, and the promotion of using reclaimed water.

Group 3 Title: Improving Quality of Life (QOL) for Bangkok’s citizen through sustainable water use and management [7]

Abstract: Bangkok is one of the urban and economic mega-centers in Asia. But the prosperity of Bangkok comes with urban hurdles, especially infrastructure and environmental weaknesses. The increasing gap between supply and demand is posing a greater threat and the city is presently facing multiple threats to its water environment, including deteriorating water quality (ground and surface water), water accessibility, wastewater management, water governance, saltwater intrusion, etc. Discussions were held that identified indicators, grouped into three categories; water and wastewater management, integrated water management, and governance. Discussions were also held to find the correlation between urban poverty and water environment, and to find out the influence of the degrading water environment on the quality of life (QOL) of Bangkok’s citizens. Taking QOL as the representative indicator, the objective of the proposal development was to improve QOL for Bangkok’s citizens by creating a mechanism for sustainable water use and management. The physical, social, and environmental dimensions of QOL were investigated, and the final outcome was formulated with both short-term and long-term holistic recommendations towards 2030 for the categories of water and wastewater management, as well as integrated water management and governance.

their efforts. The connection between the contents of the unit program and the group work topics are as follows: Group 1 picked a topic from the field visit to the E-waste recycling activity at Suan Kaew temple, and addressed the related health issues in their project. Group 2 took a hint from the field visit to the waste transfer station in Bangkok, where they observed several improper waste management practices and addressed the need for a vision for sustainable SWM. Group 3 took the example of Sainoi Landfill site in Nonthaburi and addressed GHG emission reduction issues by applying technological scenario analysis using a LCA approach.

4.4.1.2 Thailand Unit 2011

In 2011, group work was conducted based on the “approach finding” strategy for the proposal development. Given sufficient information on the unit theme and relatively less pressure of time restrictions, students were able to spend time on discussions about the sustainability indicator analysis and on the proposal development. Because the importance of the scientific approach for the proposal development was emphasized, students worked hard to collect comprehensive information by themselves and to find a logical approach to develop a proposal plan for their vision for 2030. In other words, this approach helped students develop practical leadership based on wider knowledge and expertise about the concerning issues, instead of having only idealistic but vague images for the future.

Table 4.4 shows details of the group work outcomes, which were presented in the 9th SEAWA, more than 3 months after the unit implementation. The logical approaches taken by the student groups are explained as follows: Group 1 employed an approach of system thinking and framework analysis to systematically explain their plans for the sustainable urban water use and management towards 2030. Group 2 focused on sustainability indicator development to show their visions for the 2030 qualitatively and quantitatively. Group 3 highlighted QOL as one of the most important indicators and proposal plans were presented to improve the QOL of Bangkok citizens.

4.4.2 Reviews of the Unit

To evaluate the program design and unit performance, feedbacks from the involved faculty members are shown, clearly indicating strengths and weaknesses or points for improvement in Table 4.5. There was a common strength of the unit design for both cases in that the unit was conducted by a nontraditional style of teaching with a blend of theory, practice, fieldwork and discussion. Two different approaches of the group work were also evaluated as strengths, as they work effectively to achieve the group work task. Overall, the first case in 2009 had more weaknesses and the second case in 2011 had more strengths, which indicates significant improvements in the unit design and implementation as the faculty’s experience and teaching capacity increased.

Table 4.5 Summary of the review on the two cases

	Year 2009	Year 2011
Strengths	<ul style="list-style-type: none"> – Nontraditional style of teaching with a blend of the theory, practice, fieldwork and discussion. – “Project finding” approach was effective in seeing a real-world problem with a critical eye and in practicing consensus building. – Group work outcomes were presented at the SEawe and all the participants could attend the SEawe, because it was incorporated in the field program. 	<ul style="list-style-type: none"> – Nontraditional style of teaching with a blend of the theory, practice, fieldwork and discussion. – “Approach finding” strategy was effective in developing realistic leadership based on wider knowledge and expertise about a concerning issue. – Improvement of the several weaknesses pointed out in 2009, including better information distribution, longer Q&A time in the lectures, which enhanced interaction between the lectures and students, less pressure of time limitation on students for group project completion, sufficient time for discussion and for the preparation for SEawe presentation. – Group work outcomes were presented at the SEawe.
Weaknesses	<ul style="list-style-type: none"> – Need for better information/course materials distribution for students – Need for better course management, e.g., more interaction between lecturers and students and among students – Work load was a little too heavy for the students – Despite the good opportunity to coordinate with the symposium, there was a need for enough time between the field program and the symposium presentation for better development of academic results 	<ul style="list-style-type: none"> – More time should be allocated for field activities – More demands on Japanese students from the Thai counterparts

4.4.3 *Environmental Leadership Development in Students*

To examine the effects of the unit on the leadership development in individual students, their feedback comments are summarized in Table 4.6. From the comments, it is observed that the unit had a large impact on their attitude toward leadership development. The impact varied from one student to the other. Setting the clear short-term goal to encourage SEawe conference presentations on the results of the field exercise was also effective to boost their motivation and ability to produce concrete outcomes as well as for high-level academic communication.

During the group work projects, many students showed frustration, becoming aware of their current limitations to solve real-world problems and a need for

Table 4.6 Summary of feedback comments on the leadership development*Year 2009*

- “Specific knowledge by itself doesn’t change the situation. Knowledge, vision, and communication skills are all needed to solve real-world problems.”
- “The group dilemma is a microcosm of what is happening in the real world. Policymakers spend too much time debating what should be done, leaving little time for how it will be done. Building consensus, therefore, is a skill that an environmental leader should possess in order to get things done.”
- “There is an inconsistency in waste segregation in Thailand, which is not unique to the country. The Thai government promotes segregation at the source. However, waste collectors just mixed the waste. It is therefore necessary for environmental leaders to conduct training and education for workers and the public so that they will better able to understand and share the same goal as management.”
- “For environmental leadership development, it is necessary to have a healthy attitude and enthusiasm to try to understand other technologies, cultures, and points of view.”

Year 2011

- “Things that worked effectively for leadership skill improvement were visualization of your concept, your attitude to initiate for the progress, such as action plan formulation and promotion of mutual understandings.”
- “In each group, from time to time, some naturally leading people were observed, who were equipped with the power to convince other group members and set clear steps first and head for a consensus on the framework building of the topic. In such an environment, humanity was important for inclusion of all the members.”
- “Through the experience of the field exercise, the leadership and solution process was thought out and organized to be like the following:
Learn the problem → Visualize the concept and theme → Develop a clear vision → Discuss with team of experts and various stakeholders → Develop a consensus → Reach out to the masses for their feedback → Modify the outcome using the feedback from the masses → Implementation.”
- “Even when consensus building was difficult among group members, patience, the ability to listen to others, an analytical mind and tenacity were there with everyone to convey their thoughts and listen to others for the best possible outcome. Many of the essential leadership skills seemed to be already in place with the participants but in a sporadic fashion. The success of the program was that it was able to gather the sporadic skills in a constructive way and helped everyone to augment their skills and overcome their deficiencies.”

improving their knowledge and communication skills, such as better consensus building, facilitation and English skills, etc. Nonetheless, the frustration itself should be considered one of achievements. They experienced the complexity of real-world environmental issues and tried to approach them in new ways, which would have improved diverse, balanced and integrated understanding. This is what we had aimed as the most important purpose of the leadership program, and in that sense, the Thailand Unit’s educational challenge bore fruit.

4.5 Concluding Remarks

This chapter showed how the Thailand Unit was developed and implemented year by year, by comparing the two cases on sustainable solid waste management in 2009 and sustainable urban water use and management in 2011. Successful group work

results were shown, which verified educational effects of the unit in terms of academic contents. In 2009, project finding approach was taken and it contributed to improvement of consensus building skills, while in 2011, approach finding strategy was taken and it contributed to improvement of logical approaches for the proposal development. Unit design and implementation performance were also evaluated using feedback from the faculty members. According to this evaluation, significant improvement was observed in the second year including sufficient time for group discussion at the students' initiative. Students' feedback comments also showed that the unit had a large impact in environmental leadership development. The purpose of the unit was certainly met, which aimed at achieving diverse, balanced and integrated understanding on environmental issues in students as future leaders, by the educational challenge of the unit and through the students' own great efforts.

Acknowledgments The author would like to deeply thank Prof. Chettiyappan Visvanathan from the Environmental Engineering and Management, School of Environment, Resources and Development, AIT and Dr. Chart Chiemchaisri from the Department of Environmental Engineering, Faculty of Engineering, KU for their cooperation and strong support for the Thailand Unit. Last but not least, the unit was successfully conducted by the initiative and representation by Prof. Hiroaki Furumai from the Graduate School of Engineering, The University of Tokyo.

Open Access This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited

References

1. Visvanathan C (2009) Course material of APIEL Nonthaburi unit 2009
2. Sano S, Takahashi Y, Chitapornpan S, Theeparaksapan S, Nawaz R, Clausen A (2009) Sustainable E-waste management in developing countries: economic benefits and health risks. Poster presentation at the 7th international symposium on southeast Asian water environment, AIT, Thailand, 28–30 October 2009
3. Sensai P, Muenmee S, Rukapan W, Aoki E, Bellido JCV, Zeshan S (2009) Sustainable vision for solid waste management in Bangkok. Poster presentation at the 7th international symposium on southeast Asian water environment, AIT, Thailand, 28–30 October 2009
4. Baloch AA, Ferrer J, Takahashi N, Naroiet P, Shakya S (2009) GHG emission reduction potential in a solid waste disposal site: a case study of Sainoi landfill. Poster presentation at the 7th international symposium on southeast Asian water environment, AIT, Thailand, 28–30 October 2009
5. Ghimire A, Franklin K, Chen S, Boonnorat J, Prommetjit P, An K, Hoshiko T, Honda R (2011) A framework for analysis of wastewater management system in Bangkok metropolitan area using sustainability indicators. In: Proceedings of the 9th international symposium on southeast Asian water environment, pp 125–129
6. Khanal R, Chu C, Kalaimathy SN, Thiamngoren P, Patchanee N, An K, Hoshiko T, Honda R (2011) Sustainable urban water use and management: scenario of Bangkok 2030. In: Proceedings of the 9th international symposium on southeast Asian water environment, pp 120–124
7. Biswas A, Boonyaroj V, Denpetkul T, Zhirong H, Kobayashi H, An K, Hoshiko T, Honda R (2011) Improving quality of life of Bangkok's citizen through sustainable water use and management: vision 2030. In: Proceedings of the 9th international symposium on southeast Asian water environment, pp 103–108