

Chapter 5

Environmental Leadership Education for Tackling Water Environmental Issues in Arid Regions

Tomohiro Akiyama and Jia Li

Abstract This chapter introduces one of the APIEL field exercises, the Oasis Unit, which is conducted in northwestern China. To equip the students with a wide knowledge base and practical skills, this unit is strongly field-oriented and applies in its course design the Integral Approach proposed by Ken Wilber. The approach provides a trans-/cross-disciplinary framework for identifying environmental problems of complexity, as well as bringing together methodologies from different fields and leadership qualities. After four years of implementation, the approach is considered successful in educational program design for environmental leadership and for promoting the leadership development of participants.

Keywords Environmental leadership education • Field exercise • Integral Approach • The Heihe River basin

5.1 Introduction

The United Nations Decade of Education for Sustainable Development, initiated in 2005, aims to develop and implement educational programs that focus on the three pillars of sustainability, i.e., environment, economy, and society. APIEL

This chapter is an updated version of Akiyama et al. [25].

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

J. Li

Faculty of International Studies and Regional Development, University of Niigata Prefecture,
Ebigase 471, Higashi-ku, Niigata, Niigata 950-8680, Japan
e-mail: lijia@unii.ac.jp

was established in line with the Japanese government's initiative to promote sustainability education in higher education institutions and to nurture environmental leaders. Since the concept of sustainability and present-day environmental problems are featured by the complexity of issues, APIEL has paid considerable attention to trans-disciplinary and/or cross-disciplinary education. In particular, APIEL focuses on fostering student leadership through on-site curriculum development.

At the core of the on-site curriculum, there is a course entitled as "Field Exercise" built for the purpose of practical learning. To guarantee the diversity of education methodologies and educational effects, APIEL's field exercise units can be roughly classified as either field-oriented or structure-oriented. In either case, the course consists roughly of four parts: preliminary learning; on-site learning; after-the-fact learning; and joint tasks (report preparation and presentations). Field-oriented exercises develop environmental leadership through group-based work led by students that relates to preliminary studies, planning of research activities in the field, implementation of field surveys, and the completion of solution proposals. Akiyama et al. [1] mentioned that, field-oriented exercise fosters environmental leadership mainly through the execution of field surveys, while the structure-oriented exercise fosters environmental leadership mainly through a series of educator-structured programs (i.e., in-class lectures, discussions, and short field trips).

This chapter will provide a detailed description of one of the field-oriented exercises, the Oasis Unit, which has been conducted in the Heihe River basin in arid northwestern China. The Oasis Unit especially emphasizes on the multiplicity of sustainability education and necessity for a holistic view to understand the various dimensions of environmental issues. The unit, therefore, makes the effort to apply the Integral Approach proposed by the American philosopher Ken Wilber into the practice of environmental leadership education. In this chapter, we provide an introduction to this approach, followed by its benefits for integrating academic disciplines, as well as the organizational resources and the perspectives of stakeholders used for finding solutions to environmental issues. This chapter concludes by identifying future challenges of field-oriented environmental leadership education.

5.2 Integral Approach: A Simplified Introduction

The Integral Approach aims to incorporate multiple perspectives from around the world instead of focusing on specific objects and/or specific systems of objects. Given the complexity of reality, the Integral Approach cuts across fields and brings together existing methodologies into a trans-/cross-disciplinary framework. According to Wilber [2, 3] all phenomena in the world can be categorized into four groups using a four quadrant framework. These quadrants are four ways of viewing the same occurrence in the reality from four different perspectives.

They are located in the interior and exterior of both individuals and collectives. The exterior aspects are found on the right-hand side, with physical and behavioral aspects in the upper right quadrant and social systemic aspects in the lower right quadrant. The interior aspects are found on the left-hand side, with intentional, personal, and psychological aspects in the upper left quadrant and cultural aspects (collective values) in the lower left quadrant. Although the four quadrants are ontologically distinct, there is nevertheless an interwoven, intimate correspondence among them.

Wilber's Integral Approach has received substantial attention and has been applied to a variety of fields, in both academia and practice. In particular, it is gaining attention around the world from researchers and practitioners in the field of sustainability/environment. We apply this approach because, first, it provides a holistic framework encompassing a wide knowledge base in the social, economic, cultural, and natural sciences, and second, it leads to the successful implementation of an environmental leadership education program by providing a comprehensible structure for educational curriculum design.

In the academic world of sustainability/environment, we especially draw on the following studies: Esbjorn-Hargens and Zimmerman [4], Eddy [5], Kayane et al. [6], Kayane [7, 8], Esbjorn-Hargens [9], Voros [10], and Floyd and Zubevich [11]. Among these, Kayane et al. [6] and Kayane [7, 8] are the pioneering studies that applied the approach to water environment issues. They analyzed the water environment and related changes in Lijiang City, China and Tsuwano Town, Shimane Prefecture, Japan. They argued that, first, the natural environment, especially water, is a common element related to all quadrants, and second, that the current environmental problems are often consequences induced by the abnormal development (evolution) of the lower right quadrant, i.e., rapid technological innovation in the twentieth century. We mention their works because the main topic of the Oasis Unit is water scarcity and water resources management in arid regions. The framework outlined in Kayane et al. [6] and Kayane [7, 8] was further developed in Akiyama et al. [12]. Figure 5.1 is a simplified version of Akiyama et al. [12]'s four quadrant framework related to water environmental issues.

Our framework allocates perspectives on water environmental issues into four associated quadrants. It draws on the conventional concept of sustainability/environment studies, with its emphasis on empirical research methods (quantitative and scientific), as well as alternative concepts, to encompass inter-subjective and subjective modes of inquiry (qualitative, hermeneutic, and introspective). The benefit of this framework, although requiring further research, is profound. On the one hand, it offers a common foundation for people to view various perspectives on the complexity of water environmental issues. In other words, it incorporates knowledge and methodologies from multiple disciplines. At the practical level, as far as we know, Wilber's Integral Approach has previously been applied to the fields of international development and education. In the field of international development, several international development organizations and non-governmental organizations, including UNDP (a global leadership development program around HIV/AIDS), are increasingly seeing the

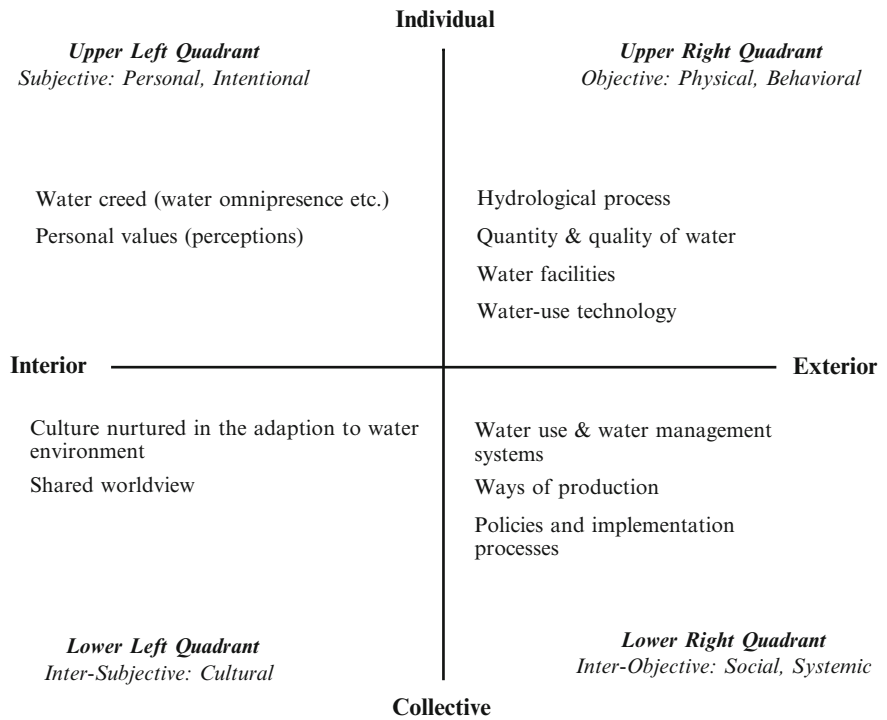


Fig. 5.1 An integral framework for water environmental issues

advantages of adopting the approach to their projects [13]. At the local level, this approach has also been used in community development projects such as the one in the San Juan del Gozo community in El Salvador [14]. In the field of education, the approach has also proved useful for curriculum development: see, for example, Gidleya and Hampson [15], Lloyd [16] and Akiyama et al. [1]. Drawing upon these practices, we designed the field exercise following the four quadrant framework presented in Fig. 5.2.

In Fig. 5.2, “I” (or “we”) refer to the participant(s) in the field exercise. This framework helps us to design a field exercise. First, it requires the field exercise design to foster self-development through personal learning as well as group work, collaboration and communication with the different stakeholders. Second, it requires the field exercise design to lead to the common conclusions of all participants, as well as to accommodate their individual views. Therefore, the field exercise should provide enough time and resources for the participants to reach a consensus and to set clear shared goals from the beginning, while also allowing for individual points of view.

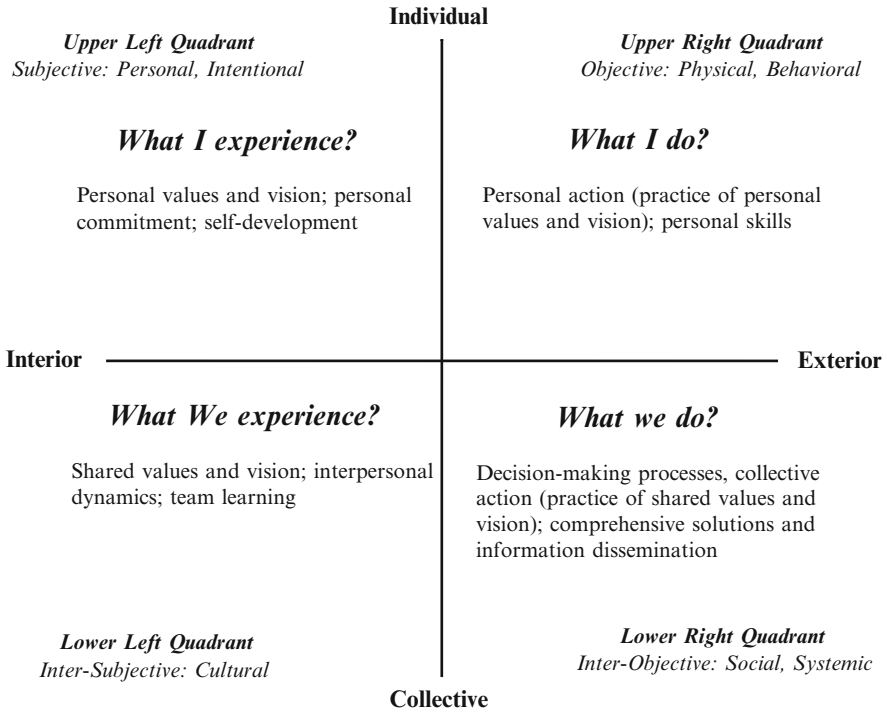


Fig. 5.2 An integral framework for environmental leadership education

5.3 Applying Integral Approach to Environmental Leadership Education

5.3.1 Oasis Unit in Northwestern Arid China

The Heihe River basin in arid northwestern China is an excellent area for fieldwork participants to consider how sustainable development could be achieved in dryland regions under severe water resources constraints. APIEL chose this river basin specifically as a target area for field exercise for the following two reasons.

First, sustainable development in dryland regions is an inevitable, current world challenge. It is associated with water security as well as food security around the world. Today, irrigated agricultural land makes up less than one-fifth of the total cultivated area in the world but produces about two-fifths of the world’s food [17]. Irrigation farming, to a great extent, contributed to the increase in food production in the twentieth century and continues to support large numbers in an increasing population. However, food production relying on the “irrigation miracle” gives

significant impacts on water resources. Agricultural water use, including irrigation, accounts for about 70% of global water withdrawals [18]. In dryland regions, large-scale development of irrigation farming induces dramatic increase of water demand. Consequently, it often results in stoppage of river flows, dry-up of lakes, decline of groundwater table and other related ecosystem degradation.

Second, the Heihe River basin, the second largest inland river in China, provides many topics for the study of sustainable development in dryland regions. In the Oasis Unit, we highlight several of these: watershed management, water-saving policies (decision-making processes, implementation and assessment), as well as environmental degradation and recovery.

In the Heihe River basin, historically, people living in the middle reaches and the ones living in the lower reaches had different ways of production. People living in the middle reaches adopted irrigation farming (settled culture); while the people living in the lower reaches adopted nomadic husbandry. Since the 1950s, intensive agricultural practices in the middle reaches have resulted in a dramatic degradation of the environment in the lower reaches. Conflicts over water use between the people living in the middle reaches and those living in the lower reaches date back at least 200 years ago [19–21]. However, these conflicts have never been as fierce as today. The intensive exploitation of water resources in the middle reaches has largely declined the amount of water flows to the lower reaches. By 2002, more than 30 tributaries of the Heihe River basin had dried up. In the lower reaches, two terminal lakes dried up in 1961 and 1992, respectively. Riparian vegetation degraded. Salinization and desertification intensified. The desertification in the lower reaches has attracted substantial attention nationwide and is thought to be the origin of dust storms in the spring.

In recent years, a range of environmental conservation activities has been carried out in the river basin, particularly Zhangye, a city in the middle reaches. The main purpose of environmental conservation activities is to preserve the environment in the lower reaches. At the core of those activities is the Integrated Water Resources Management Plan of the Heihe River Basin promulgated by the Chinese State Council in 2001. This plan states that “when the river discharge from the upper reaches amounts to 1.58 billion m³/a, Zhangye City, located in the middle reaches of the Heihe River basin, has to increase discharge of 0.225 billion m³/a to the lower reaches, which means 0.95 billion m³/a should be released to the lower reaches” [22]. In other words, the central government requires the city of Zhangye to reduce water consumption by administrative order. Since 2001, Zhangye has been repeatedly selected as an experimental site for pilot programs of water resource management. In particular, in early 2002, the Ministry of Water Resources of China initiated an experimental project for establishing a water-saving society in the middle reaches at Zhangye. The project was set to save water and increase water use efficiency mainly in two ways: (1) by building concrete irrigation channels using government funds; (2) by introducing market mechanism. The policies include introduction of meters to charge for irrigation water based on the amount used, and the introduction of water use rights system with tradable water quotas. At the same time, in Ejina in the lower reaches, a relocation policy has been implemented because overgrazing was considered one reason for environmental degradation.

5.3.2 *Making the Field Exercise Unit Integral*

Applying Integral Approach to environmental leadership education is an evolving process that is far from completion. There are external constraints, such as those on human resources, finance and time that prevent the ideal development of a program. In addition, the students, who have come through a relatively narrow education system, do not always know how to respond to a new, holistic way of learning. Therefore, when we design the Oasis Unit, we focus on an integral knowledge base as well as integral practices.

Table 5.1 presents a brief description of the Oasis Unit. Started in 2009, it takes place once a year. With integral thinking as the general framework for program design, we extended the content of the field exercise (from 2009 to 2012) to incorporate more perspectives related to environmental issues, and provided more experiences for students to develop practical skills. The field exercise is jointly organized by APIEL, The University of Tokyo, and Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), Chinese Academy of Sciences. Students who join the field exercise are from both institutes. They come from different countries and major in several academic fields. To provide the students multidisciplinary knowledge and multiple views about local environmental problems, faculty members from different academic fields as well as local stakeholders were involved in the different stages of the fieldwork. We have established close relationships with CAREERI and the local water authority to move beyond the limits of universities as well as to let students know that they are tackling real-world problems. The students are required to make policy recommendations and deliver this information to the local water authority. In addition, in 2011 and 2012, the collaboration was strengthened by working with several other institutions from both Japan and China. We hold international symposia in Japan and in China to build a platform for students to hear fresh voices from academia beyond faculty members, government officials, and businesspeople.

Figure 5.3 is an overview of the organizational framework used in our field exercise. Note that students are the leading players. We simply created the space for students to see real-world environmental problems and to realize their own development. In Fig. 5.3, environmental issues (*Issues addressed*) are the research topics covered by the students; *methodologies* are those adopted by the students; *competencies* are the capabilities and/or skills that students are expected to develop through participating in the field exercise.

Problem-solving based learning is the core concept of the course design. It reveals related issues, brings together the necessary research methodologies, and consequently improves participants' competence to become environmental leaders in the future. The main objective of the field exercise is to enhance the students' practical skills through solving specific environmental problems in the real world. Issues in each quadrant have different perspectives for the same environmental problem: sustainable development of the Heihe River basin, which is facing severe water shortages. The issues are interwoven. To provide comprehensive solutions

Table 5.1 Description of the field exercise unit in the Heihe River Basin

	2009	2010	2011	2012
Place(s)	Zhangye, Gansu Province	Middle and lower reaches of the Heihe River basin (Zhangye, Gansu Province, and Ejina, Inner Mongolia)	Zhangye, Gansu Province	Zhangye, Gansu Province
Duration	9 days (August 7–15)	14 days (August 10–23)	13 days (August 27–September 7)	13 days (August 4–16)
Collaborating institution(s)	CAREERI	CAREERI	CAREERI	CAREERI; Sophia University
Students	9 students from 4 countries	16 students from 7 countries	10 students from 6 countries	12 students from 6 countries
Major subjects of students	Sustainability science, urban engineering, geography	Sustainability science, urban engineering, geography	Sustainability science, urban engineering, geography	Sustainability science, urban engineering, geography, global environmental studies
Academic specialties of faculty members	Seven faculty members: water environmental engineering, hydrology, geology, limnology, geography, economics, and sustainability science			
Stakeholders	Researchers (local and foreign); local government officials (water management authority); local farmers			
Activities	(1) Lectures; (2) site visits; (3) discussions and communications with stakeholders; (4) quantitative and qualitative analyses; (5) group work; (6) results reporting (group-based)			
Follow-up activities	–	–	International symposium jointly held with GelK of Kumamoto University and EDL of University of Tsukuba	International symposium jointly held with the Water Management Authority, GPSS-GLI of The University of Tokyo, GelK of Kumamoto University and EDL of University of Tsukuba
Required outcome	Unique proposals for local policymakers on solutions to water-related issues in the Heihe River basin			

Note: *GPSS-GLI* Graduate Program in Sustainability Science-Global Leadership Initiative; *GelK* International Joint Education Program for Groundwater Environmental Leaders; *EDL* Environmental Diplomatic Leader Program

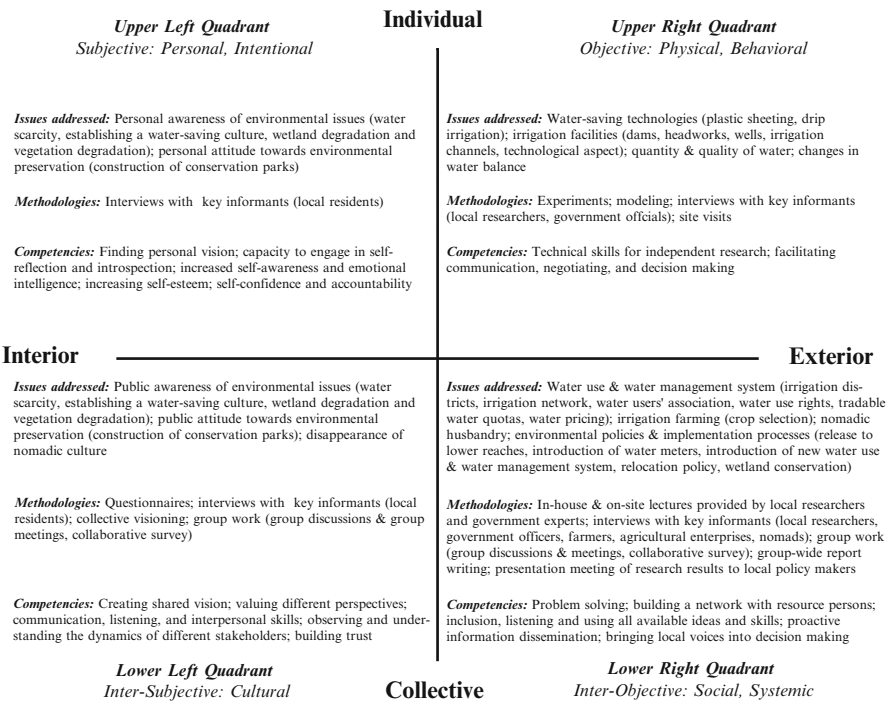


Fig. 5.3 Integral organizational framework for the field exercise unit

for multiple issues, different methodologies from diverse fields are required. Although they cut across quadrants, natural science methods, including experiments and quantitative modeling, are mostly required to tackle the issues in the upper right quadrant. For the lower right quadrant, social science methods are mostly required. In the case of two left-side quadrants, humanity-based, hermeneutic methods are mostly required. Problem-based learning is the core concept of the course design. It brings up related issues and brings together the necessary research methodologies.

The competencies identified in Fig. 5.3 were not intentionally selected by us. They developed naturally in the process of participating in fieldwork, especially through group work. Team-based activities require the students to listen to, understand, and assimilate different ideas while contributing to groups from their respective fields and perspectives. Students need to find common research interests and decide on common research topics, as well as adapt to change, and finally to solve the problems. In addition, competencies spill over quadrants. For example, good communication skills may foster students' understanding of the varied concerns of the stakeholders, to create a shared vision, and to integrate methodologies and fields to find comprehensive solutions.

5.4 Experiences and Lessons Learned from the Oasis Unit

After four years, participants in the Oasis Unit generally consider that the unit has increased their understanding of the multiple dimensions of environmental issues and helped to improve their leadership skills/competencies. An et al. [23] reports the results of a questionnaire survey directed at Oasis Unit participants. The key points from this survey and students' comments after they joined the Oasis Unit are included as follows.

The questionnaire in An et al. [23] was adopted and modified from Gordon and Berry [24] to examine the educational effects of the Oasis Unit. The questionnaire was designed to monitor the students' way of thinking about environmental leadership, skill acquisition, pedagogy etc., before and after their participation of the field exercise. The questionnaire contains eight statements that reflect the most common current ideas about leadership. The respondents were asked to choose from five different points on a scale ranging from "strongly agree" to "strongly disagree." The results revealed obvious changes in awareness before and after the students participating in Oasis Unit. The Oasis Unit participants identified the participatory, open model and visible leadership through "field exercise." In addition, most of the Oasis Unit participants put more emphasis on the importance of leadership education development through practical experience. Oasis Unit participants tend to disagree with the statement that "leadership skills are inborn and intuitive." However, they also tend to have a higher awareness about the difficulties of developing environmental leaders. They seem to realize that participatory leadership requires time and resources which in turn requires a consensus among the stakeholders to achieve time-bound goals. This is presumably because in a field-oriented course, most of the students have their first experience of working with people from different cultural and academic backgrounds. In many cases, there is also a language barrier, which often hinders their ability to express their own ideas and to reach agreements with each other.

In general, former participants were satisfied with the content provided by the Oasis Unit. They think that a field-oriented environmental leadership course promotes positive cross-cultural interactions among students and faculty members. Many of them also mention that the involvement of local stakeholders and faculty members from different academic fields provides a comprehensive, balanced understanding of environmental issues. The students feel that their leadership skills were developed throughout the unit.

However, the Oasis Unit also has some clear shortcomings. The main problem is how to limit the amount of knowledge conveyed in advance by faculty members as well as a guarantee of the depth of the understanding of students. During the past four years, since we have put an emphasis on student initiatives and consensus building, the faculty members have been trying to limit the contents of pre-survey lectures to relevant fundamental knowledge. The students are required to find specific research questions and make detailed survey plans by themselves. Often, they start to realize after departure that their research proposals do not reflect local realities. The students sometimes need to make major adjustments to research proposals after

departure. As a result, they often have to spend lots of time on discussions and the final survey appears to lack the depth and scope due to time constraints.

5.5 Concluding Remarks

The complexity of current environmental problems is triggering mounting concerns about the integration of academic fields to find solutions for sustainability of human future. There arises the need to equip students with a wide range of knowledge base and practical skills in terms of social, economic, cultural and physical dimensions of environmental issues. Undoubtedly, in the absence of established models, it is a challenge to move toward a holistic view for educational programs. In this chapter, we introduced a framework developed from Ken Wilber's four quadrant approach. This framework was built upon the core concept of problem-based learning. It has been adopted by one field-oriented course for environmental leadership development: the Oasis Unit, initiated by APIEL, The University of Tokyo. After four years of implementation, we have found that program participants were enthusiastic about and satisfied with the course. Therefore, we conclude that the use of the Integral Approach is effective for not only understanding complex environmental issues, but also the development and management of environmental leadership education programs. However, at the practical level, we also see difficulties with maintaining the depth/effectiveness of course content as well as a guarantee for students to use their initiative and to develop leadership skills within a limited time.

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