

INTEGRAL LEADERSHIP EDUCATION FOR SUSTAINABLE DEVELOPMENT

Tomohiro Akiyama, Jia Li, and Motoharu Onuki

ABSTRACT To date, there is no well-established theoretical framework in the field of education for sustainable development. This study contributes to the literature by developing an integrated framework for environmental leadership education (i.e., Integral Leadership Education for Sustainable Development [ILESD]). The framework is an application of the all-quadrants, all-levels (AQAL) model of Integral Theory. Taking into consideration the viewpoints of students and educators, we propose two four-quadrant models that represent two types of ILESD models. One model represents components of environmental leadership inherent in students, while another model represents components of education programs. The ILESD models were utilized to evaluate the University of Tokyo's Asian Program for the Incubation of Environmental Leaders (APIEL). The evaluation results suggest three challenges facing APIEL: 1) establishment of integrated environmental studies; 2) further curriculum development focusing on environmental leadership; and 3) establishment of an evaluation methodology vis-à-vis educational effectiveness.

KEY WORDS education; environmental leadership; Integral model; Japan; sustainable development

The United Nations Decade of Education for Sustainable Development (UNDESD) was initiated in 2005. Its purpose is to develop and implement educational programs that focus on the environment, economy, and society. Since the concept of sustainability has received considerable attention in a variety of academic fields, transdisciplinary and/or cross-disciplinary education fulfills an important role in driving sustainable development. Against this background, Japan has been developing Education for Sustainable Development (ESD) in her higher-education institutions in recent years. In particular, Japan initiated the Strategy for an Environmental Nation in the 21st Century (endorsed by Japan's Cabinet in June 2007) and a long-term strategic guideline ("Innovation 25," endorsed by Japan's Cabinet in June 2009), both of which prioritized the nurturing of environmental leaders.

At the practical level, the Japanese government has promoted the Project to Develop Environmental Leadership Programs in Higher Education (Environmental Leadership Initiatives for Asian Sustainability undertaken by Ministry of the Environment) and the Strategic Program for Fostering Environmental Leaders (undertaken by the Ministry of Education, Culture, Sports, Science and Technology) since 2008. The main purpose of these two projects/programs is to establish and implement educational programs that help foster environmental leaders. In particular, the Strategic Program for Fostering Environmental Leaders is part of the Japanese government's key policy of supporting science and technology diplomacy. Foreign students in Japan from various regions of the world are expected to learn about environmental technologies and policies, which will in turn help them support sustainable societies in their home countries. The University of Tokyo was one of the very first institutions that was selected to participate in this program.

In the literature, the role of environmental leaders in society and the necessity of environmental leader education have been thoroughly discussed (see, for example, Berry & Gordon, 1993; Egri & Herman, 2000;

Correspondence: Tomohiro Akiyama, Graduate School of Frontier Sciences, University of Tokyo, Environmental Studies Building 334, 5-1-5, Kashiwanoha, Kashiwa City, Chiba 277-8563, Japan. *E-mail:* akiyama@k.u-tokyo.ac.jp.

Gordon & Berry, 2006).¹ To date, however, theoretical frameworks and methodologies for education that support environmental leadership development have not been established. First, there are no basic theories or frameworks that can be used to determine what organizational systems, curricula, and educational methods are necessary and what abilities should be developed. Additionally, no theoretical frameworks or methodologies to be used in program evaluation have yet been established. In order to make these programs more effective, it is imperative to verify both their educational effects and the factors therein (Prieto et al., 2009).

Gitachari Srikanthan and John Dalrymple (2002) provide a good literature review of quality management in higher education. They compared various existing approaches, and proposed building a new approach that creates synergy between educational and organizational theories. Regarding environmental leadership education, it is doubtful whether the quality management theories in conventional pedagogy are applicable or not. Environmental leadership education, due to its root from sustainability development, requires an exceptionally holistic course design and learning processes that cross existing academic disciplines.²

Recently, an integrated method called the all-quadrants, all-levels (AQAL) model, as developed by Ken Wilber (2000), is gaining attention in the education field as an effective way of teaching and designing curricula (Esbjörn-Hargens, 2006).³ The AQAL model features a high level of integration of the various perspectives on education. For example, it might be possible to discuss the applicability across, within, and between disciplinary boundaries, interactions between educators, and students, and integration of orthodox as well as alternative educational methods. As far as we know, our work is the first study to apply the AQAL model to environmental leadership education. In this article, we analyze the University of Tokyo's Asian Program for Incubation of Environmental Leaders (APIEL).⁴ We evaluate the current education effects of APIEL and discuss the possibility to improve the design and implementation of its curriculum.

Methods

The Integral Approach

Wilber's (1996, 2000, 2007) integrated methodology features a four-quadrant framework which contends that reality is composed of holons. All holons have both an objective exterior expression and a subjective interior experience. At the same time, all holons are both individuals and members of a collective. These two distinctions between the exterior and interior, and the individual and collective, give rise to four aspects of reality, or four ways of knowing, represented by the quadrants. The exterior aspects of reality are found on the right side, with physical and behavioral aspects in the Upper-Right quadrant and social systemic aspects in the Lower-Right quadrant. The interior aspects of reality are found on the left side, with intentional, personal, and psychological aspects in the Upper-Left quadrant and cultural aspects in the Lower-Left quadrant. Although the four quadrants are ontologically distinct, Wilber suggests that there is an interwoven, intimate correspondence between all four quadrants.

Wilber (2000) points out that various conventional academic disciplines only focus on one quadrant. Physics, biology, neurology, and other hard sciences have focused on the Upper-Right quadrant; social sciences and other system sciences on the Lower-Right quadrant; studies concerning phenomenology, introspective psychology, and consciousness on the Upper-Left quadrant; and studies concerning values, concepts, worldviews, and cultures, the Lower-Left quadrant. Since the introduction of Integral Theory (Wilber, 1996, 2000, 2007), the four-quadrant approach has been widely applied not only to academic fields including environmental studies, education, and psychology, but has also been put into practice in business and international cooperation (e.g., Akiyama et al., 2010; Brown, 2006; Brown, 2007; Eddy, 2005; Floyd & Zubevich, 2010; Gidley & Hampson, 2005; Esbjörn-Hargens, 2005; Esbjörn-Hargens & Zimmerman, 2009; Hochachka, 2008; Kayane, 2006, 2008; Kayane et al., 2006; Lloyd, 2007; Voros, 2001).

Development of an Integrated Framework for Environmental Leadership

As part of an integrated framework for environmental education, we propose the use of a four-quadrant approach to Integrated Education for Sustainable Development (IESD). In addition, two integrated models within IESD will be proposed, as they are defined according to the viewpoints of students and educators. Since education for environmental leadership development is one pattern of IESD, we call it Integral Leadership Education for Sustainable Development (ILES D). Our two integrated models within ILES D are defined below.

In one model, ILES D focuses on the components of any environmental leadership education program (i.e., the perspective of educators). In particular, this model addresses alternative education (Upper-Left quadrant) and orthodox education (Upper-Right quadrant) (Fig. 1a). We made this division because an orthodox curriculum is often single-discipline oriented with the exclusion of knowledge of other disciplines. Additionally, in an orthodox curriculum, educators are knowledge holders, while students are basically information receivers. In contrast, an alternative curriculum addresses the interior aspect of what is needed for environmental leadership education, including awareness, insight, and the interaction of people involved. Consequently, an alternative curriculum is considered to be interactive, student-initiated, and problem-solving oriented. In terms of the Lower-Right quadrant, we address educational regimes including educational organizations/systems, instructional design, and evaluation of those organizations/systems (e.g., Magliaro & Shambaugh, 2006; Sadler, 1989). We also address the cultural aspects of any educational program in the Lower-Left quadrant, such as shared values, educational goals, and interpersonal relationships among students/faculty. All the aforementioned quadrants are thought to affect the impact that education can have on students. Consequently, whether these four quadrants can be integrated is a topic of utmost importance.

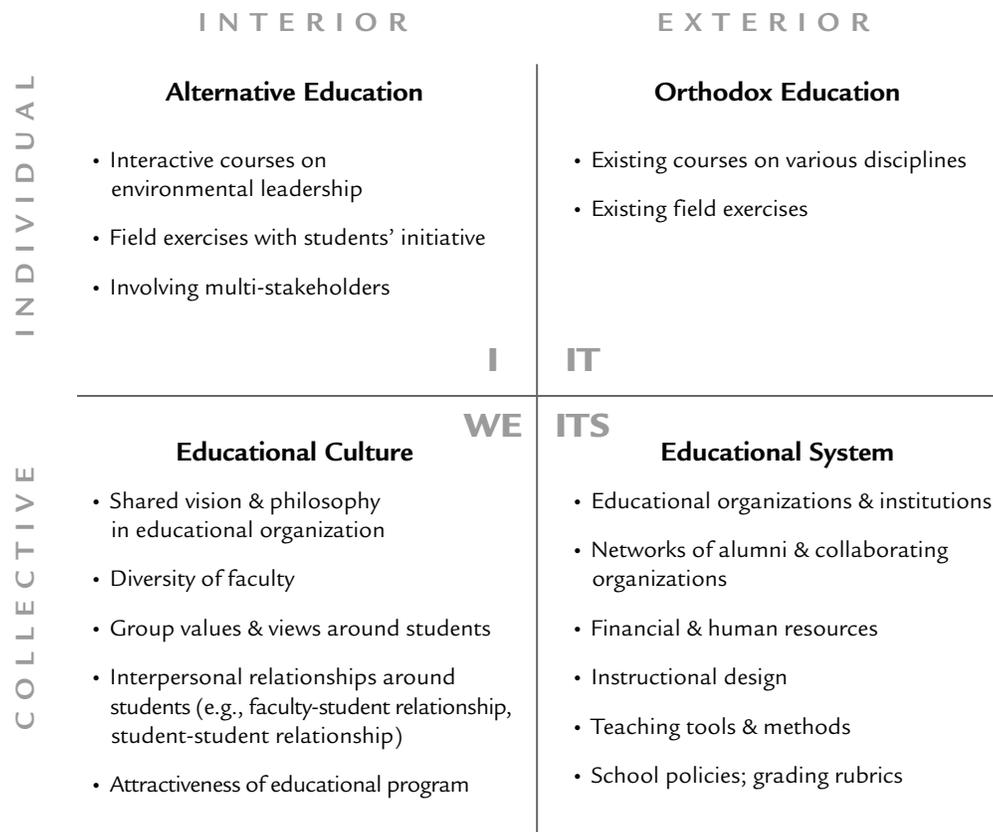


Figure 1a. Four-quadrant model of Integral Leadership Education for Sustainable Development for educators.



Figure 1b. Four-quadrant model of Integral Leadership Education for Sustainable Development for students.

In another model, we define the quadrants from the perspective of students (Fig. 1b). This model closely aligns with the existing theories pertaining to environmental leadership. Since leadership is often thought of in terms of knowledge, skills, and attitudes, these dimensions are often collectively referred to as “KSA” (Haynes, 2006; Xiao & Lo, 2003); we, too, use this term below. Corresponding to the Upper-Left and Upper-Right quadrants, we define Intentional Leadership (subjective leadership) and Behavioral Leadership (objective leadership). On the other hand, corresponding to the Lower-Left and Lower-Right quadrants, we define Cultural Leadership (intersubjective leadership) and Social Leadership (interobjective leadership). These allotments not only represent environmental leadership in terms of the four-quadrant framework, but all four varieties of leadership already exist as technical terms in a number of related fields. This finding suggests that leadership theories have been discussed in isolation within these fields, and that they have seldom been integrated. We believe environmental leadership requires the integration of all these leadership types, as shown in Figure 1b.

Here, we further elaborate the four aforementioned leadership types in the context of environmental leadership theory. Behavioral Leadership refers to an individual’s ability to work toward the realization of a vision. A leader’s behavior is, in itself, a mover of the leader’s subjective determination or proactive intention. Intentional Leadership refers to value aspect of leadership such as an individual’s values, ideas, vision, and philosophy (Lee & King, 2000; Lum, 1997). On the other hand, Cultural Leadership relates to shared values

within a group, the establishment of trusting relationships, and a culture of organization and society and their development (Hallinger, 2004; Hewison, 2004; Trice & Beyer, 1991). We consider Behavioral Leadership as it relates to the personal behavior of an environmental leader, whereas Social or Systematic Leadership relates to the abilities required to promote certain actions on the part of a group. Clearly, the latter form of leadership is in the realm of environmental leadership. In short, what is required of an environmental leader is the ability to lead human groups, including society-based ones, in addressing environmental problems. This ability touches, for example, on organizational leadership—including process consultation, organizational diagnostics and analysis, coaching, facilitation, system design, and management—as an innovative and practical method of promoting organizational development. However, Social or Systematic Leadership, in the context of environmental leadership, includes the ability to pinpoint environmental problems through teamwork in order to solve problems, be socially accountable, and propose solutions. Due to the wide range of matters that environmental leadership encapsulates, educators (Fig. 1a) must give special consideration to the fact that students are equipped with various elements of leadership from the different quadrants (Fig. 1b).

Implementation of APIEL

In line with the ILESD model proposed in the two panels of Figure 1, we take APIEL as a case study and summarize its current state of environmental leadership education with respect to each quadrant. As shown in Figure 1a, the systemic aspect of an education program, including its curriculum design, creation of educational organizations, and educational research networks with other institutions, is in the Lower-Right quadrant. Cultural aspects of an education program, including shared vision and goals of its teaching members, are in the Lower-Left quadrant. Intentional aspects of an education program, including alternative activities that facilitate environmental leadership and appear to be interdisciplinary, are in the Upper-Left quadrant. Behavioral aspects of an education program, including the courses established from conventional academic disciplines and focusing on knowledge transfer from educators to students, are found in the Upper-Right quadrant.

Interobjective Aspect of APIEL

The organization of APIEL features an interdisciplinary framework and the development of collaborative networks among academia, government, business and the public, both domestically and internationally. APIEL was established in 2008, in light of Japan's initiatives to assist in developing international environmental leaders. It is jointly operated and managed by the Graduate Program in Sustainability Science (GPSS; Division of Environmental Studies, Graduate School of Frontier Sciences) and the Department of Urban Engineering (UE; School of Engineering) of the University of Tokyo. GPSS was created in 2007, and it integrates a number of different majors (e.g., natural environmental studies; human and engineered environmental studies; sociocultural environmental studies; international development studies; ocean technology, etc.), in a cross-sectional manner. GPSS offers both master and doctoral programs aimed at nurturing human resources that can actively participate in promoting the sustainability of human society and the global environment at the international level. UE has an urban environmental engineering course (with subjects such as environmental assessment, environmental technologies, risk control) and an urban planning course (with subjects such as transportation, disaster prevention, national land and regional planning, historical and cultural landscape and design, space recognition). These courses provide an interdisciplinary education and research opportunities in urban engineering, and for over 40 years it has produced a broad array of human resources, including government officials, business leaders, and researchers.

It is generally considered difficult to manage educational programs across departments. Given the distance between campuses, and the fact that students are enrolled in a distinct department of GPSS and UE, a base for the APIEL program was established in each of the two departments. Close collaboration between two

departments is made possible by a teleconference system. Teaching members work at two campuses of the university and play core roles in basic operations, such as selecting students and planning and implementing various types of courses.

In addition, APIEL has a Steering Committee, a Planning and Management Committee, and an External Advisory Board, and it holds project staff meetings and internal seminars on the development of educational systems. First, the Steering Committee was created in order to integrate GPSS and UE, to facilitate smooth management. Vice Deans of the Graduate School of Engineering and the Graduate School of Frontier Sciences participate in the Committee to establish a system that allows for full collaboration with the university headquarters. The Steering Committee's roles are to develop bylaws; specify curriculum details, credit requirements, and execution instructions; and certify students who have completed the courses. Second, the Planning and Management Committee was formed under the Steering Committee's umbrella. This Committee consists of a chief coordinator at GPSS; a chief coordinator at UE; and specially appointed academic and administrative staff members. The committee members work together to locate collaborative counterparts; foster collaboration with those counterparts; allocate personnel; and establish and implement curriculum details, credit requirements, and execution instructions. This Committee meets, on average, once or more per month to make decisions required for the daily management of the program. Third, APIEL has also established an External Advisory Board comprising external experts to solicit their advice concerning program management and curriculum formation; the overarching aim of this Board is to promote the program in a global, long-term manner.⁵

The creation of domestic and international collaborative networks has been promoted through APIEL's management and implementation practices. For example, efforts to establish collaboration with the business sector have been continuously made domestically, particularly through the university's division of external affairs. Considerable support has been provided to date by the Nissan Science Foundation, the Coca-Cola Educational & Environmental Foundation, and Daiwa Securities Group, Inc. In addition to securing financial aid, APIEL has set up joint workshops and symposia to assist in knowledge exchange.

In particular, given the importance vis-à-vis field-oriented practical education, developing cooperative relationships with counterparts in other Asian countries has been considered to be essential to the program. Existing networks involving the Division of Environmental Studies, the Graduate School of Frontier Sciences, and UE are fully utilized, while efforts to discover new links are continuously under way. The counterparts who, to date, have promoted synergistic environmental field exercises are shown in Table 1; they include 14 educational research institutions in 6 countries/regions. In addition to these institutions, many local government agencies and companies have also assisted in the program. Environmental field exercises are planned and managed in close partnership with local organizations. These facts reflect APIEL's strong intention to nurture environmental leadership of students on an interdisciplinary knowledge base and multi-stakeholders' perspective.

Intersubjective Aspect of APIEL

APIEL has made efforts to incorporate the panoply of faculty, students, and counterpart institutions of different countries and stakeholders, as well as to create a shared vision of its educational program. As of February 2011, APIEL had received 72 students from 27 countries, with 56% of those students coming from outside Japan; they are diverse in terms of specializations and backgrounds. Students eligible for this program—limited to enrollees looking to acquire credits—are examined for selection on the basis of English-language essays and an interview. In its first round of recruitment, APIEL selected 25 students, six more than had initially been expected. In addition to the diversity in terms of students' specialties and backgrounds, APIEL highlights a curriculum emphasizing a direct understanding of on-site environmental problems through on-the-ground information garnered by various people in the regions across Asia.

To create a school culture incorporating diversity and a common vision about sustainability, APIEL's courses employ an interactive teaching style and many of the assignments are group-based. For example, in the compulsory course that covers environmental issues ("Environmental Challenges and Leadership in Asia"), instructors will present one real-world problem in a specific region of Asia. The students are requested to share opinions with each other and think about comprehensive solutions based on their discussions. In the case of field exercises, students are requested to create research proposals, carry out surveys, and find solutions for real-world environmental issues. Through exposure to people of different backgrounds, student self-awareness and negotiation skills to reach consensus are expected to improve.

APIEL uses the word "resonance" to underscore the importance of accommodating diversities and mutual understanding. These are, as explained in detail by Onuki and colleagues (2009), "interdisciplinary resonance," predominantly in academic fields; "interregional resonance," which is required for the formation of partnerships and networks among educational and research institutions in various Asian regions; and, finally, "resonance with graduates." According to APIEL's vision, if such resonances are established, people with different types of expertise who are from different cultures and who adhere to different concepts can understand their collective diversity and influence their counterparts en route to creating a better society.

APIEL has a diverse faculty and student body, but it also has made efforts to create a vision that is singular and shared (i.e., to maintain a high quality of education). For example, when the number of initial APIEL students was larger than anticipated, the number of students per environmental field exercise was not increased, but the number of field exercises provided was increased. In this way, the student-to-instructor ratio was kept low so that the faculty of each environmental field exercise would be able to closely connect with and supervise each student. This change was brought about as a result of collaboration among the teaching members. As a result, 16 environmental field exercises have been formed to date (Table 1).⁶

Subjective Aspect of APIEL

To address the interior aspect of what is needed for environmental leadership education, APIEL established a compulsory course, "Environmental Challenges and Leadership in Asia," and a companion course, "Field Exercise." In the former, students learn, in an interactive manner, about environmental leadership and various environmental problems in Asia. In the latter, practical issues are examined with cooperative counterpart(s) in a region that is deemed to have an ongoing environmental problem. These courses are structured to develop students' perception vis-à-vis environmental problems and develop the skills and abilities required of environmental leaders. In addition, elective courses are structured from existing lecture courses, so that students can deepen both their professional knowledge and their skills.

In the "Environmental Challenges and Leadership in Asia" course, students improve their understanding of the history of environmental issues in Asia, as well as other issues, including different cultural viewpoints and how to learn, in a hands-on manner, how environmental leadership makes use of certain KSA (knowledge, skills, and abilities) in making professional contributions to a sustainable society. The course uses case studies of various environmental issues in many Asian regions; it also makes heavy use of group discussions and presentations. To develop students' communication and consensus-building abilities, a remote lecture system has been adopted so that various students with different majors can interactively participate in the courses. For theme studies, for instance, as one task, students are required to bring papers and books that they feel are most important for the construction of a sustainable future. By sharing those reading materials, students become aware that perceptions of a sustainable future can differ vastly. In addition, discussions among students help hone capabilities in developing cooperative relationships based on mutual understanding. In a sense, one could say that students in this compulsory course learn how to learn from others.

For practical learning, APIEL dispatches students to various regions for periods between 10 and 14 days for the "Field Exercise" course. The purpose of the course is to nurture the personal qualities required

		Academic year 2009				Academic year 2010									
		Overseas field exercise		Domestic field exercise		Overseas field exercise		Domestic field exercise							
Intensive Program on Sustainability	Zhangye unit	Bangkok unit	Nonthaburi unit	Chiang Rai unit	Greater Pearl River Delta (GPRD) unit	Eco-Industrial Cluster	Japan International Cooperation Agency (JICA)	Oasis unit	Hue unit	GPRD unit	Coca-Cola Young Environmental Leaders Summit	Internship in the Tokyo Fringe project on Low Carbon Green Asia	Tokyo Fringe unit	Nissan-iPoS	Green Energy unit
Food, Energy and Water	Water-related issues in arid region	Urban development and agriculture-related issues in suburban Bangkok	Sustainable solid waste management in Asian developing countries	Transboundary environmental issues	Environmental Leadership Development in the GPRD, China	Eco-Industrial Cluster	Sewage works engineering, and Stormwater Drainage Technology (JICA)	Sustainable integrated watershed management in cold and arid region	Flood and History in world heritage Hue city	Sustainable urban regeneration and relocation of industrial regions in the GPRD, China	Corporate Social Responsibility	Low-carbon society.Scenario in Asia	Urban development and agriculture-related issues in suburban Tokyo	Sustainable cities & mobility in 2050	Sustainable energy supply
Rayong Province, Thailand	Zhangye, Gansu Province, China	Bangkok, Thailand	Nonthaburi Province and Bangkok, Thailand	Golden Triangle, Chiang Rai, Thailand	Honglong and Guangzhou, China	Asian Development Bank Institute (ADB) (Tokyo)	JICA (Tokyo)	Zhangye, Gansu Province & Ejina, Inner Mongolia, China	Hue, Vietnam	Hongkong and Guangzhou, China	Konyama, Hokkaido	ADB (Tokyo)	Kashiwa, China & Nerima, Kokubunji, Hachioji, Tokyo	Hayama town, Kanagawa Prefecture	Kashiwazaki, Niigata & Ueno, Gunma
Aug. 1-12	Aug. 6-15	Sep. 14-23	Oct. 21-30	Dec. 19-30	Feb. 25-Mar. 7	Oct. 2009-Jan. 2010	Nov.-Dec.	Aug. 10-23	Aug. 11-19	Feb. 21-28	Aug. 19-23	Nov. 2010-Feb. 2011	Sep. 5-12	Dec. 4-13	Feb. 21-23
Asian Institute of Technology (AIT) etc.	1. Cold & Arid Regions Environment & Engineering Research Institute, Chinese Academy of Sciences (CAREERI), 2. Zhangye Water Authority	Chulalongkorn Univ. (CU)	1. AIT, 2. Kasetsart Univ. (KU)	Mae Fah Luang Univ. (MFLU)	1. Hong Kong Univ. of Science & Technology (HKUST), 2. Sun Yat-sen Univ. (SYSU)	ADB	1. JICA, 2. Sewerage Business Management Centre	1. CAREERI, 2. Zhangye Water Authority, 3. Alashan-SEE Ecological Association, 4. Wusonggu Village & Jinglangtu Village, Ejina	Hue Univ. (HU)	1. HKUST, 2. SYSU	1. All counterparts of the overseas field exercise units in academic year 2009, 2. Hokkaido Univ., 3. Coca-Cola Educational & Environmental Foundation, 4. NPO Kuriyama, Chemical Company Limited	ADB	CU	AIT etc.	1. Tokyo Electric Power Company, 2. Korea Environmental Policy & Administration (KEPA) Society, 3. Prince of Songkla Univ. (PSU), 4. Kashiwazaki city
Univ. of Tokyo (UT) (3) AIT (2)	UT (4) CAREERI (2)	UT (1) Wakayama Univ. (WU) (1) CU (2)	UT (5) AIT (1) KU (1)	UT (3) MFLU (2)	UT (5) HKUST (1) SYSU (1)	UT (1)	UT (1)	UT (5) Univ. of Niigata Pref. (UNP) (1) CAREERI (3)	UT (4) HU (1)	UT (4) HKUST (1) SYSU (1)	UT (4)	UT (11) WU (1) CU (2)	UT (7) AIT (2)	UT (5) UNP (1) KEPA (1) PSU (1)	
1 Ethiopian 2 Japanese N.B. 23 participants	1 Indonesian 1 Thai 1 Chinese 2 Japanese	1 Colombian 1 Filipino 2 Japanese	1 Filipino 1 Bolivian 3 Japanese	1 Indonesian 1 Cambodian 2 Sri Lankan 3 Japanese	1 Irish 1 Swiss 1 Bangladeshi 1 Portuguese 2 Chinese	1 Portuguese	1 Brazilian 1 Chinese 1 Japanese	1 Ethiopian 1 Bhutanese 1 French 1 Vietnamese 1 Mongolian 1 Chinese 2 Japanese	1 Dominican 1 Bangladeshi 2 Filipino 1 Korean 1 Chinese 4 Japanese	1 Ethiopian 1 Australian 1 Filipino 1 Vietnamese 1 Thai 1 Malagasy 2 Chinese 2 Japanese	1 Irish 1 Indonesian 1 Ethiopian 1 Cambodian 1 Thai 1 Bangladeshi 2 Filipino 1 Bolivian 1 Portuguese 2 Japanese	1 Mongolian	1 Cambodian 1 Filipino 2 Japanese	1 Australian 1 Dominican 1 Chinese 1 Japanese N.B. 28 1 Dominican 1 Nepali 1 Bahraini 1 Bhutanese 1 Vietnamese 1 Jamaican 1 Chinese 1 Japanese	
Student nationality	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff	Teaching staff

Table 1. List of APIEL's field exercises. Gray, light gray, and white colors show structure-oriented exercises, field-oriented exercises, and internship programs, respectively.

of environmental leaders in recognizing environmental issues and solutions, especially from holistic viewpoints. This course consists roughly of four parts: preliminary learning, on-site learning, after-the-fact learning, and a joint task consisting of a presentation and report preparation. Overseas and domestic exercises lead to the award of two credits and one credit, respectively.

Table 1 provides a list of the field exercises that have been implemented to date. Overseas field exercises are roughly classified as being either field-oriented or structure-oriented. Field-oriented exercises develop environmental leadership mainly through group-based work led by students, from that relating to the preliminary studies, planning of research activities in the field, implementation of field surveys, and the completion of solution proposals. Environmental leadership is fostered through the execution of field surveys. The structure-oriented exercise develops environmental leadership mainly through a series of educator-structured programs (i.e., in-class lectures, discussions, and short field visits). In all, there is a balance between five field-oriented and four structure-oriented exercises. Further information on the activities that take place in each exercise is found in newsletters posted on the APIEL website (<http://www.envleader.u-tokyo.ac.jp>).

All field exercises bear the following common characteristics: 1) they are interdisciplinary in nature, 2) they involve a number of different stakeholders, 3) they foster students' initiative, and 4) they feature practical issues that lack prepared solutions. Although the field study takes place over a relatively short time-period, it is possible for students to examine environmental issues on-site and discuss them with the various stakeholders involved; this engagement is made possible by the participation of local governmental agencies and companies and the cooperation of counterpart universities/research institutions. Furthermore, this educational program is designed to ensure participant diversity (i.e., to avoid an overconcentration of Japanese graduates). This design feature thus pushes students to improve their techniques in communicating with others of various cultural backgrounds.

APIEL differs greatly from the project-based learning outlined by DeFillippi (2001), Frank et al. (2003), and Helle et al. (2006) in terms of how fieldwork is led by students and how a diverse range of stakeholders participate. For example, in APIEL's field exercise called Oasis Unit (formerly Zhangye Unit; Table 1), students take the initiative in developing an interdisciplinary research plan about the issues related to water resource management. They do so while addressing practical challenges that lack prepared solutions. As a final task, students must summarize their survey results and make policy suggestions to the local government.

Attempts are also being made to promote interaction among field exercise units. A joint presentation meeting of the final reports of different units is one such attempt. There are also student sessions within the international symposia and workshops that help deepen discussions among domestic and international experts. Through such joint activities, it is possible for participants to share not only lessons learned from their fieldwork, but also approaches to various types of environmental issues. Teaching members, in particular, have made the effort to join most final-presentation meetings, participate in different field exercise units, and further develop their own educational skills. In this way, APIEL is also directing its energies into the development of new educational methods that will nurture a more comprehensive range of human resources.

Objective Aspect of APIEL

In line with conventional academic disciplines, APIEL offers a group of elective courses based on the specialties of GPSS and UE. Although it depends on the preference of the instructor(s) of each course, elective courses are mostly lecture-based (i.e., there are few interactions among students or between the professors and students). Compared to UE, the topics of the GPSS courses are broader and incorporate environmental, social, and economic aspects of sustainability. UE courses focus tightly on finding technical/engineering solutions to urban environmental problems. Although each course is single-discipline oriented, the overall selection of a group of courses takes into account interdisciplinary elements.

Future Challenges

In investigating the future issues to be addressed by APIEL, whether or not the program integrates the four quadrants of Wilber's paradigm is a topic worth exploring. First, APIEL represents a system that works to create and develop educational organizations and a curriculum that addresses interdisciplinary approaches to practical issues, and to construct domestic and international networks that involve academia, business, and government. From the systemic point of view, APIEL covers various elements essential to an environmental leadership education program (Lower-Right quadrant). Second, regarding the cultural aspect (Lower-Left quadrant), APIEL created an environment that accommodates various diversities, and the teaching members have made efforts to reach a shared vision. These aspects were addressed in the initial design of APIEL and are considered to enhance the program's attractiveness. Third, APIEL offers a variety of courses that are both orthodox and discipline oriented (Upper-Right quadrant) as well as alternative and oriented to problem-solving (Upper-Left quadrant). Therefore, APIEL as an educational program does cover all four of the Integral model's quadrants, and evolving interactions among them are evident.

However, some issues can be extracted for further consideration. We will take up the following three issues: 1) the establishment of a formalized Environmental Studies curriculum (Lower-Left quadrant in Fig. 1a); 2) the reinforcement of a curriculum focusing on the development of environmental leadership (Upper-Left quadrant in Fig. 1a); and 3) the establishment of a method by which the effects of education can be evaluated (Lower-Right quadrant in Fig. 1a). The necessity of addressing these challenges is discussed below, based on ILESD.

First, the establishment of Environmental Studies has dovetailed with the evolution in how the environment is perceived, within the context of education for the development of environmental leaders. For this reason, this matter is equivalent to a cultural facet that would be found in the Lower-Left quadrant. Based on the ILESD model presented in this article, better environmental leadership is contingent upon the integration of the four quadrants of the educational program in Figure 1a. Even if all but the Lower-Left quadrant evolves, integration will not occur if there is a lack of theory or methodology for Environmental Studies. Since it is considered difficult to develop a true environmental leader without the establishment of a shared Environmental Studies vision, the creation of the Environmental Studies discipline is considered the most important challenge.

Has the Environmental Studies discipline been genuinely established? "Knowledge" that integrates the natural and social sciences is essential in properly dealing with environmental issues, which tend to involve both nature and human beings. However, knowledge derived from the natural and social sciences has not yet been integrated, as evidenced by the tendency of some researchers to use the term *environmental science* (Kayane, 2006). Some researchers have discussed how human beings should relate to nature, but this reminds one of Cartesian dualism; nature and human beings cannot be separated, and for this reason, human beings should not work against nature (Kayane, 2006). On the other hand, a school of thought has emerged that suggests a shift from relativism to holism, and this school is considered to be at the heart of sustainability science (e.g., Clark & Dickson, 2003; Kajikawa, 2008; Kates et al., 2001; Komiyama & Takeuchi, 2006; Swart et al., 2002; Turner et al., 2003).

The definition of *sustainability science* states that it provides a foundation that aims to elucidate mechanisms defining global, social, and human systems and their interactions; reconstructs the three systems for sustainability; present measures and visions pertinent to the rehabilitation of those interactions; and ultimately realizes a sustainable society (Kauman, 2009; Komiyama & Takeuchi, 2006). This definition is based on the general systems theory of Bertalanffy (1976) and Dubrovsky (2004). Under Wilber's four-quadrant framework, this theory is roughly equivalent to the Lower-Right quadrant's collective-exterior aspects because it takes systems science as its starting point.

Next, let us discuss the reinforcement of curricula for the development of environmental leadership.

This reinforcement is thought to strengthen curricula, as there is a significant difference between the number of current elective courses and the number of new courses for the development of environmental leadership. Many elective courses offer expertise and skills; there are others, but those that cover the attitudes required for environmental leadership are limited to the compulsory course “Environmental Challenges and Leadership in Asia” and the companion course “Field Exercise.” It may be necessary to establish a course that focuses on followership theory as it pertains to leadership theory. In addition, it is important to develop new curriculum not limited to the current framework inherent in lecture-based courses and fieldwork exercises, and consider altogether novel frameworks in the development of environmental leadership. For instance, APIEL has made efforts to organize activities that bear horizontal links with different field exercise units, including joint presentation meetings that involve a variety of field exercise units, the Coca-Cola Young Environmental Leaders Summit Unit, and student sessions in workshops and international symposia (Table 1).

It is necessary and desirable to evaluate differences in educational effectiveness among the various educational methods available in order to make decisions that will lead to improvements within individual established courses. For instance, there has been discussion of whether field-oriented or structure-oriented field exercises are better. The first author of this article favors field-oriented training for the following reason: Isamu Kayane (2007) has argued that the mind is generated from a mutual interference between an individual and environments. This hypothesis has been supported by several brain-science researchers (e.g., Nakada, 2000, 2003, 2004). Therefore, it is important to focus on field-oriented learning, which puts students into relevant environments to stimulate their study incentives.

Finally, the creation of a method by which educational efforts can be evaluated has become an important challenge. The ILESD model, as presented in this article, may make a contribution to the establishment of basic theory in this area. When a questionnaire survey is conducted, for instance, the ILESD model can apply to a case in which the number of questions should be uniformly set for the four quadrants. However, a complicated interaction between the “four quadrants for educational programs” (Fig. 1a) on the outside of a four-quadrant holon for education for the development of environmental leaders, and “four quadrants for environmental leadership of human resources to be developed” (Fig. 1b) on the inside of the holon cannot be fully elucidated. Consequently, the ILESD outlined in this article is thought to contribute to the establishment of such an evaluative methodology. The ILESD, however, is simply one of the theoretical frameworks used within education for the development of environmental leaders. It is essential to propose other new frameworks and methodologies in the future.

When these new frameworks and methodologies are indeed proposed, it is important that a thorough literature review be prepared, based on diversified perspectives other than the context of environmental leadership theory. In addition, practical approaches that adopt leading-edge findings vis-à-vis leadership education should also be reviewed. For instance, a method emerging from the Kennedy School at Harvard University (Heifetz et al., 1989) may become very informative. An examination of the Kennedy School at Harvard University in the ILESD suggests the integration of the four quadrants within an organization and within leadership education itself. E-learning, in which the use of online educational materials is facilitated through the use of information technology, is expected to serve as a new educational platform in the 21st century. It is time to establish and fine-tune educational theory vis-à-vis environmental leadership, based on the latest research results.

Conclusion

This article used the four quadrants of the Integral framework to develop an integrated model of ILESD for environmental leadership education. APIEL’s approach was analyzed in terms of ILESD; we found that the program design of APIEL accomplished a certain level of integration among the four quadrants, but it will be necessary to continue efforts to further hone the curriculum for the development of environmental leaders.

Future challenges to consider include 1) the establishment of an integrated environmental studies curriculum, 2) the reinforcement of a curriculum focusing on environmental leadership, and 3) the establishment of a methodology by which educational effects can be evaluated.

It is necessary to discuss further new theoretical frameworks and methodologies. In particular, leadership theory has been examined in a number of disciplines, resulting in a sizable accumulation of research results. As a direction for future research, it is important to prepare a thorough literature review based on a diversity of perspectives other than the context of environmental leadership theory. Additionally, it may be important to evaluate existing education programs, including APIEL, from the students' perspective (i.e., what the students actually experience and think).

NOTES

¹ The definition of *environmental leadership* varies in the literature. For example, Berry and Gordon (1993) define environmental leadership as the ability of an individual or group to guide positive change toward a vision of an environmentally better future. Egri & Herman (2000) define environmental leadership as the ability to influence individuals and mobilize organizations to realize a vision of long-term ecological sustainability. Although the differences between environmental leadership and traditional leadership are sometimes delineated, most literature focuses on the ability to influence or change society.

² Even if using the same word, *holistic*, a holistic view of environmental leadership education is essentially different from that of education of traditional disciplines. It could be the accommodation of different stakeholders' perspectives, or knowledge from different fields, and so on. For example, Prieto and colleagues (2009) argue that it is essential to determine evaluation criteria from the perspectives of various stakeholders.

³ At the core of Wilber's framework are four quadrants labeled "I", "We", "It", and "Its." Wilber sheds light on the holarchical structure of the universe and human beings—including substances, lives, and minds—and vividly instructs the reader on the human position and how the species should exist and coexist in the future (Kayane, 2006). Wilber's four-quadrant framework, which is all-inclusive in its consideration of perspectives, can be used to both plan and evaluate an education program. Note that a holarchy is a nested hierarchy of holons, while each holarchy is itself part of another, larger holarchy (Wilber, 1996).

⁴ APIEL was previously discussed by Onuki and colleagues (2009), but the authors describe it here to avoid overlap wherever possible, and fully consider its past implementation status.

⁵ The external experts that constitute the Board include domestic and international university professors; experts from international organizations such as the World Bank and the UNEP; and environmental experts from government agencies and private companies. In addition to these administrative bodies, meetings led by teachers who look to support the development of educational systems and methods are also organized. Research on the development of educational systems and methods has given rise to the publication of a total of 10 academic papers, including those of Onuki and Mino (2009), Akiyama et al. (2010), and An et al. (2011). This research focus, as the *raison d'être* of APIEL, is of paramount importance and will continue to be explored in the future.

⁶ As of February 2011, a "Certificate for the Completion of the Asian Program for the Incubation of Environmental Leaders, University of Tokyo" was awarded to 11 graduates; another 21 graduates received this honor in March 2011.

REFERENCES

- Akiyama, T., Li, J., Tokunaga, T., Onuki, M., An, K. J., Hoshiko, T., & Ikeda, I. (2010). Integrated approach to environmental leadership education: an exploration in the Heihe River basin, northwestern China. In *Proceedings of the 8th International Symposium on Southeast Asian Water Environment*, 40-49.
- An, K. J., Akiyama, T., Kim, J. Y., Hoshiko, T., & Fu-

- rumai, H. (2011). The influence of field-oriented environmental leadership education on leadership development. *Procedia Social and Behavioral Sciences*, 15, 1271-1275.
- Beck, D., & Cowan, C. (1996). *Spiral dynamics: Mastering values, leadership, and change*. Oxford: Blackwell.
- Berry, J.K., & Gordon, J.C. (1993). *Environmental leadership: Developing effective skills and styles*. Washington: Island Press.
- Bertalan, L.V. (1976). *General system theory: Foundations, development, applications*. New York, NY: George Braziller.
- Brown, B.C. (2006). The use of an integral approach by UNDP's HIV/AIDS group as part of their global response to the HIV/AIDS epidemic. Retrieved May 26, 2011, from <http://www.integralworld.net/pdf/Brown.pdf>.
- Brown, B.C. (2007). The four worlds of sustainability—drawing upon four universal perspectives to support sustainability initiatives. Boulder, CO: Integral Institute.
- Clark, W., & Dickson, N.M. (2003). Sustainability science: The emerging research program. *Proceedings of the National Academy of Sciences of the United States of America*, 100, 8059-8061.
- DeFillippi, R.J. (2001). Introduction: Project-based learning, reflective practices and learning. *Management Learning*, 32, 5-10.
- Dubrovsky, V. (2004). Toward system principles: General system theory and the alternative approach. *Systems Research and Behavioral Science*, 21, 109-122.
- Eddy, B.G. (2005). Integral geography: Space, place, and perspective. *World Futures*, 61, 151-163.
- Egri, C.P., & Herman, S. (2000). Leadership in the North American environmental sector: values, leadership styles, and contexts of environmental leaders and their organizations. *The Academy of Management Journal*, 43, 571-604.
- Esbjörn-Hargens, S. (2005). Integral ecology: The what, who, and how of environmental phenomena. *World Futures*, 61, 5-49.
- Esbjörn-Hargens, S. (2006). Integral education by design: How integral theory informs teaching, learning, and curriculum in a graduate program. *ReVision*, 28, 21-30.
- Esbjörn-Hargens, S., & Zimmerman, M. E. (2009). *Integral ecology: Uniting multiple perspectives on the natural world*. Boston, MA: Shambhala.
- Floyd, J., & Zubevich, K. (2010). Linking foresight and sustainability: An integral approach. *Futures*, 42, 59-68.
- Frank, M., Lavy, I., & Elata, D. (2003). Implementing the project-based learning approach in an academic engineering course. *International Journal of Technology and Design Education*, 13, 273-288.
- Gordon, J.C., & Berry, J.K. (2006). *Environmental leadership equals essential leadership: Redefining who leads and how*. New Haven, CT: Yale University Press.
- Hallinger, P. (2004). Meeting the challenges of cultural leadership: The changing role of principals in Thailand. *Discourse: Studies in the Cultural Politics of Education*, 25, 61-73.
- Haynes, A. (2006). On commissioning editors. *Journal of Scholarly Publishing*, 37, 237-250.
- Helle, L., Tynjala, P., & Olkinuora, E. (2006). Project-based learning in post-secondary education—Theory, practice and rubber sling shots. *Higher Education*, 51, 287-314.
- Heifetz, R.A., Sinder, R.M., Jones, A., Hodge, L.M., & Rowley, K.A. (1989). Teaching and assessing leadership courses at the John F. Kennedy School of Government. *Journal of Policy Analysis and Management*, 8, 536-562.
- Hewison, R. (2004). The crisis of cultural leadership in Britain. *International Journal of Cultural Policy*, 10, 157-166.
- Hochachka, G. (2008). Case studies in integral approaches in international development. *Journal of Integral Theory and Practice*, 3, 58-108.
- Kajikawa, Y. (2008). Research core and framework of sustainability science. *Sustainability Science*, 3, 215-239.
- Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., et al. (2001). Sustainability science. *Science*, 292, 641-642.
- Kauman, J. (2009). Advancing sustainability science: report on the international conference on sustainability science (ICSS) 2009. *Sustainability Sci-*

- ence, 4, 233-242.
- Kayane, I. (2006). *Foundations of environmental issues in modern China* [in Japanese]. International Center for Chinese Studies: Aichi University, Japan.
- Kayane, I. (2007). On an environmental philosophy. *Journal of Geographical Research*, 47, 1-16.
- Kayane, I. (2008). Environmental problems in modern china: Issues and outlook. In S. Kawai (Ed.), *New challenges and perspectives of modern Chinese studies* (pp. 265-285). Tokyo: Universal Academy Press, Inc.
- Kayane, I., Miyazawa, T., & Zhu, A. (2006). Water and society in the old town of Iijiang. *Water Science*, 291, 41-72. In Japanese.
- Komiyama, H., & Takeuchi, K. (2006). Sustainability science: Building a new discipline. *Sustainability Science*, 1, 1-6.
- Lee, R.J., & King, S.N. (2000). *Discovering the leader in you: A guide to realizing your personal leadership potential*. San Francisco, CA: Jossey-Bass.
- Lloyd, D.G. (2007). An integral approach to learning. *International Journal of Environmental, Cultural, Economic and Social Sustainability*, 2, 27-33.
- Lum, B.J. (1997). Student mentality: Intentionalist perspectives about the principal. *Journal of Educational Administration*, 35, 210-233.
- Magliaro, S.G., & Shambaugh, N. (2006). Student models of instructional design. *Educational Technology Research and Development*, 54, 83-106.
- Nakada, T. (2000). Vortex model of the brain: The missing link in brain science? In T. Nakada (Ed.), *Integrated human brain science* (pp. 3-22). Amsterdam: Elsevier.
- Nakada, T. (2003). Free convection schema defines the shape of the human brain: Brain and self-organization. *Medical Hypotheses*, 60, 159-164.
- Nakada, T. (2004). Brain chip: A hypothesis. *Magnetic Resonance in Medical Sciences*, 3, 51-63.
- Onuki, M., & Mino, T. (2009). Sustainability education and a new master degree, the master of sustainability science: The graduate program in sustainability science (GPSS) at the University of Tokyo. *Sustainability Science*, 4, 55-59.
- Onuki, M., Ota, M., Hoshiko, T., Hanaki, K., & Mino, T. (2009). Development of Asian Program for Incubation of Environmental Leaders (APIEL) [in Japanese]. *Environmental Conservation Engineering*, 38, 719-725.
- Popper, K.R. (1963). *Conjectures and refutations*. London: Routledge.
- Prieto, L.C., Gilmore, J., & Osiri, J.K. (2009). Environmental leadership development: A framework for designing and evaluating a training program. *European Journal of Social Sciences*, 9, 586-593.
- Sadler, D.R. (1989). Formative assessment and the design of instructional systems. *Instructional Science*, 18, 119-144.
- Srikanthan, G., & Dalrymple, J.F. (2002). Developing a holistic model for quality in higher education. *Quality in Higher Education*, 8, 215-224.
- Swart, R., Raskin, P., & Robinson, J. (2002). Critical challenges for sustainability science. *Science*, 297, 1994-1995.
- Trice, H.M., & Beyer, J.M. (1991). Cultural leadership in organizations. *Organization Science*, 2, 149-169.
- Turner, B.L., Kasperson, R.E., Matson, J.J.M., Corell, R.W., Christensen, L., Eckley, N., et al. (2003). A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences of the United States of America*, 100, 8074-8089.
- Voros, J. (2001). Reframing environmental scanning: An integral approach. *Journal of Futures Studies*, 3, 533-551.
- Wilber, K. (1996). *A brief history of everything*. Boston, MA: Shambhala.
- Wilber, K. (2000). *A theory of everything: An integral vision for business, politics, science and spirituality*. Boston, MA: Shambhala.
- Wilber, K. (2007). *Integral spirituality: A startling new role for religion in the modern and postmodern world*. Boston, MA: Shambhala.
- Xiao, J., & Lo, L.N.K. (2003). Human capital development in Shanghai: lessons and prospects. *International Journal of Educational Development*, 23, 411-427.

INTEGRAL LEADERSHIP EDUCATION

TOMOHIRO AKIYAMA holds a D.Sc. degree from Nagoya University in Japan. He is currently working as a project assistant professor in Graduate School of Frontier Sciences at the University of Tokyo in Japan. He has published several articles about water environment issues in Asian arid regions. Recently, he has been working on the application of the Integral approach to sustainability studies and education practice in higher education.

JIA LI holds a Ph.D. degree from Nagoya University in Japan in international development. She is currently working as an assistant professor in the Faculty of International Studies and Regional Development at the University of Niigata Prefecture in Japan. She specializes in economics. Her main research interests include financial capital flows and environmental problems (energy, water) in developing countries.

MOTOHARU ONUKI holds a Ph.D. degree (Engineering) from the University of Tokyo in Japan. He is currently working as a Project Associate Professor in Graduate School of Frontier Sciences at the University of Tokyo in Japan. He has been studying competences and pedagogies of sustainability education and leadership education in higher education, and working to establish Graduate Program in Sustainability Science (GPSS) in the Graduate School of Frontier Sciences.