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Master's Thesis

Sustainability Education and Diversity

- In the context of higher education in Japan -

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Declaration

This thesis is submitted in partial fulfilment of the requirements for The University of Tokyo, Graduate School of Frontier Sciences, Degree of Master of Sustainability Science.

I certify that this is a presentation of my original research work. Wherever contributions of others are involved, every effort has been made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions. The work was done under the principal guidance of Professor Mino Takashi of the Graduate Program in Sustainability Science.

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Nguyen Linh Dan

In my capacity as the principal supervisor of the candidate's thesis, I certify that the research was conducted in accordance with the degree regulations and the above statements are true to the best of my knowledge.

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Mino Takashi

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Date

Dedicate to you - my loving parents and my husband.

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This is a qualitative research which primarily based on case study and survey. Therefore, every single contribution to the questionnaire is immensely appreciated. I wish to show sincere gratitude

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Abstract

This treatise is going to work on the relationship between sustainability education and diversity of students. Studying diversity is not an unexplored topic, especially with respect to racial and ethnic heterogeneity. Both positive and negative impacts have been found on the productivity and learning outcomes when various types of individuals study or work together. Then the questions are how and why diversity of students is important to this new type of education? Authors like Dietz (2009); Piland et al. (2000); Thatcher (1999); Winchester (2002) have invested their thoughts in determining the relationship, but no works to date have analyzed the new elements in sustainability education.

Limiting the scope of research to Japan, the main question is *How does the diversity of students affect the sustainability education in higher education?*. Qualitative Research and Case study are the basic methodology of the study. Methods include Documents, Archival records, Interviews, Direct observation, Participant-observation, and Physical artifacts (Yin, 1994). Additionally, expert consultation and a number of test surveys are inevitable steps prior to conducting the questionnaire to students. Online Surveymonkey® and Excel Spreadsheet 2007 are where data are processed.

Two case studies on sustainability education were carried on: one short-term and one long-term education. Both IPOS (Intensive Program on Sustainability) and IR3S (presently SSC - Sustainability Science Consortium) education are providing sustainability courses and calling for students from various academic backgrounds and cultures. Key contents of research questions are about the sources of new knowledge on Sustainability; the benefit from the study environment; the difficulties during interactions; and student motivations. Learners have both positive and negative reflection on the study with diversity of fellow students.

According to retrieved data, a diverse student body proves to be more educationally effective than a more homogeneous one. Students were quite uncomfortable with some certain difficulties, but they finally felt at ease with the diversity. Critical thinking and participation skill are improved the most while systems thinking perhaps is cultivated in long-term study. Classroom climate (contributed by teachers, school leaders, and the members of the class) is the important part to produce good learning outcomes. Integrating both Asian and Western education style in a study environment is recommended. International students, specifically in Japan, should be in a diverse class rather than in a homogeneous climate with almost all Japanese students. Not only is diversity significant to sustainability education but also pedagogy, curriculum, or teacher methodology are as important, implicating the need for further research.

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Nomenclature

AASHE Association for the Advancement of Sustainability in Higher Education

AIT   Asian Institute of Technology

DAAD German Academic Exchange Service

EFS   Education for Sustainability

ESD   Education for Sustainable Development

IPoS   Intensive Program on Sustainability

IR3S   Integrated Research System for Sustainability Science [1]

MEXT Ministry of Education, Culture, Sports, Science and Technology

MOE   Ministry of Environment

SE   Sustainability Education

SSC   Sustainability Science Consortium

UNDESD United Nations Decade of Education for Sustainable Development

UNU-ViE United Nations University Vice Rectorate in Europe

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[1] In this research, IR3S is used in parallel with SSC, indicating the same group.

Chapter 1

Introduction

1.1   Problem Statement

Since the beginning of the 21st century, along with the popularization of UNDESD, educational programs on sustainability in higher education started to be offered in virtually every university in the world, especially in more developed countries. The emergence of the sustainability movement in higher education can be traced to the recognition of the importance of greening universities early in the environmental education movement going back to the late 1960s and 1970s, and to the term sustainable development, which arose in 1972 at the United Nations Conference on the Human Environment in Stockholm (Corcoran et al., 2004).

Regarding the grand education industry of the USA, extracted from the AASHE Homepage, The Association for the Advancement of Sustainability in Higher Education, there are now 42 Bachelor's, 36 Master's and 8 Doctoral degree programs in "Sustainability" all over thousands of universities and educational institutions. Currently more than 320 universities from 38 European countries are participating the network for sustainable development, and practical teaching and research collaboration is ongoing within the network to encourage sustainable development (Copernicus Campus Sustainability Center 2006) (after Uwasu et al., 2011). Active players in Europe supposedly gather in the European Sustainability Science Group (Jager, 2009), consisting of universities or research centers in UK, Sweden, Netherlands, Switzerland, Germany, Belgium, Austria and Spain. Australia is a very progressive nation in promoting environment as well as

sustainability programs. Well-known ANU (Australian National University), University of Melbourne, Macquarie University and 21 other institutions offer courses in Sustainable Development[1]. In Japan case, Japan's Action Plan for the UNDESD was issued in March 2006 as a blueprint for the implementation of measures to promote ESD in Japan (Kitamura and Hoshii, 2010). In line with the action plan, various initiatives to promote ESD in higher education have been introduced, mainly by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of the Environment (MOE).

Likewise, universities are witnessing an increase in the level and types of diversity among students in sustainability courses. Many college and university decision-makers already intuitively know that diversity is a prerequisite for such an education (Hurtado, 2001). They [*some universities that have placed international matters in the mainstream of their educational endeavors*] recognize that international experiences such as study abroad and cultural exchanges can educate students to be better prepared for the global society (Horie, 2002). Taking five national universities in Japan as an example, including Hokkaido, Ibaraki, Tokyo, Kyoto, Osaka University, all of them together initiated a sustainability educational program under the ground of Integrated Research System for Sustainability Science. The Graduate Program in Sustainability Science in The University of Tokyo was established as an interdepartmental masters program of the five departments in the Division of Environmental Studies (Onuki and Mino, 2009), yearly calling for students all around the world to join an English-based educational program from 2007. The program names itself as transdisciplinary orientation, welcoming students from different backgrounds. In sustainability education at Osaka University, ideas are to increase the students' awareness of their own diversity and to increase their ability to communicate in different fields, by holding diverse discussions between students even in lecture classes and having students pursuing different majors do group work together for themes demanding interdisciplinary competency (Uwasu et al., 2011). It is also stated that ensuring students realize the needs of society is important issue from the perspective of ensuring student diversity and maintaining student motivation, not just at Osaka University or Hokkaido University, both of which spread the

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[1] Source: My green life http://www.mygreenlife.com.au/Resources/coursesinsustain

programs across their entire curricula, but also even in full major programs of sustainability science at schools such as The University of Tokyo. Onuki and Mino (2009) have concluded that accepting diversity and respecting minorities in a diverse international society are extremely important aspects of sustainability education. Heterogeneity is expected to have a positive effect, but the prediction is made with caution (Michael A. Campion, 1993).

1.2 Objectives and Hypotheses

1.2.1 Objectives

The research aims at finding the impacts of the diversity of students onto the sustainability education in the context of higher education. More specifically, there are five sub-objectives that it would like to achieve:

1. To demonstrate the theoretical foundations of the relationship between sustainability education and the diversity of students;

2. To review the popularity of Japanese universities with sustainability courses and how sustainability science programs in selected universities are arranged;

3. To show the impact of diversity on sustainability teaching and learning (which involves student reports on learning in classes with other classmates of varied background knowledge and cultural bases);

4. To compare the similarities and differences among diversity of students in terms of cultural and disciplinary backgrounds in short-term and long-term education; and

5. Additionally, in the process of revealing the role of diversity, the research at the same time seeks for further elements important to the education.

1.2.2 Hypotheses

1. Diversity of students imposes a relatively strong influence on sustainability education;

2. In a heterogeneous study environment, most of the new knowledge of sustainability are from class peers instead of from the instructors as in traditional education system;

3. Diversity, on the contrary, leads to various difficulties for learners;

4. Long-term education with diversity of students is likely to accompany more impediments than short-term period.

Scope of the study

Central concern of the thesis is the relationship between the diversity of students and sustainability education. In universities, sustainability presents an opportunity to make education more problem based, more interdisciplinary and more applied (Corcoran et al., 2004), therefore doing research directed to higher education is reasonable. To make the study more feasible and virtual, the authors choose to test the hypotheses in the case of Japan, where host university is located. Lastly, two dimensions of diversity (cultural and disciplinary heterogeneity) are focused in to trim the complexity that might occur. Rationale for this selection will be explained in the Chapter 2.

1.3 Prospective Contributions

To the students Students may understand more about the value of friends' differences around them. This helps them be willing to accept and respect diversity in the university as well as in lives, henceforth helps reach all five goals of sustainability education, which are learning to know, to do, do be, to live together and to change.[1]

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[1] See Chapter 2, section 2.1.2

To the class instructors Many of the lectures have been given by top-down method, when the instructor completes his/her task merely by giving information and explanation throughout the session. Consequently, no matter how class students are arranged, almost nothing critically change with respect to students' learning outcome. However, if the instructor adjusts the viewpoint upon the diversity versus homogeneous, he will know how to make use of it and cultivate fruitful discussions.

To the school leaders or curriculum designers Results of this research hopefully could contribute to the ideas of the school decision makers, who have strong power in student recruitment, curricula development and research funding.

To the policy makers The research hints suggestions for redirecting educational policy, financial distribution to international students and syllabus advancement towards rearranging class composition to an effective diversity.

To current literature and provide all readers of the thesis with an interesting little new findings about diversity and education for sustainable development.

1.4   Research Design

Chapter 2 will be describing some recognized definitions around Sustainability Education term, what the characteristics of SE are, and how it has been developing itself from the original type of education. This chapter uses the notable theory of UNESCO namely Pillars of Education, which was introduced by Delors et al. in 1996 and then adds it up with controversial ideas about the next pillar to form Sustainability Education. In addition, the meaning of Diversity is also discussed and defined in the research context; as well as the relationship between diversity of students and sustainability in higher education. This relationship is described thanks to a very important bridge of transdisciplinarity. After this chapter, objective (1) would be illustrated.

Chapter 3 guides readers to the theoretical methodology that is the skeleton throughout the research. This is a qualitative study which uses quantitative-integrated survey and case study as the primary methodology. Ergo, the concept of qualitative research and case study is explained carefully so as to understand how the methodology looks like and why it is chosen to conduct this educational research. Analysis about the strengths and limitations is integrated in order to highlight the characteristics of a qualitative research in education.

The next two chapters report the first case study on a short-term sustainability education called Intensive Program on Sustainability (IPoS) and the second on long-term education which takes the Sustainability Science Consortium in Japan as a research object. General information on each program will be given at the beginning, then specific methods and instruments used are to be explained subsequently. Results of one case are presented question by question in the survey or interview for readers to easily follow. Chapter 5 also partly makes clear objective (2).

Analysis of the collected data will be discussed in Chapter 6, so as to verify the next objective. In the last part of *Discussion*, we will see how objective (4) is demonstrated.

Lastly, the final chapter is going to wrap up the talks by reconfirming objectives and hypotheses with some typical research limitations, then open up the directions for future studies.

For your information, Appendix will include the questionnaires relatively of the first and the second case study.

Chapter 2

Literature Review

2.1 Sustainability Education and the Fifth Pillar

2.1.1 Education for Sustainable Development or Education for Sustainability?

Among the terminologies that indicate a new type of teaching and learning fit for developing a trending society of sustainability, "Education for Sustainable Development" is apt to be the most popular. Education for Sustainable Development (ESD) was first described in Chapter 36 of Agenda 21. ESD is more than a knowledge base related to environment, economy, and society, which is in need of: improving basic education, reorienting existisng education to address sustainable development, developing public understanding, awareness, and training (McKeown et al., 2006). Moreover, it is a vision of education that seeks to balance human and economic well-being with cultural traditions and respect for the earth's natural resources. It emphasises aspects of learning that enhance the transition towards sustainability including citizenship education; education for a culture of peace; gender equality and respect for human rights; health education; population education; education for protecting and managing natural resources; and education for sustainable consumption (UNESCO, 2009).

Education for sustainable development (UNESCO Homepage):

- is based on the principles and values that underlie sustainable development;

- deals with the well-being of all four dimensions of sustainability environment, society, culture and economy;

- uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills;

- promotes lifelong learning;

- is locally relevant and culturally appropriate;

- is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences;

- engages formal, non-formal and informal education;

- accommodates the evolving nature of the concept of sustainability;

- addresses content, taking into account context, global issues and local priorities;

- builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, an adaptable workforce, and a good quality of life;

- is interdisciplinary. No single discipline can claim ESD for itself; all disciplines can contribute to ESD.

These essential characteristics of ESD are said to be implemented in myriad ways so that ESD programmes reflect the unique environmental, social, cultural and economic conditions of each locality. Furthermore, ESD increases civil capacity by enhancing and improving society, through a combination of formal, non-formal and informal education.

Apart from ESD, various labels are used to describe this sustainability process such as Education for Sustainability (EFS); Education (or Learning) for Sustainable Future; Learning for Sustainability; Learning for Sustainable Development; Co-learning for Sustainability; Education as Sustainability and

so on. Learning for sustainability, for instance, is learning to change the world to make it more viable and sustainable that calls for the need for learning to be personally empowering and enriching, and to respond to learners' diverse learning needs and intelligences (Combes, 2005). When we begin to consider learning in the context of sustainability, it suddenly becomes important to consider a wide range of learned behaviors and cognitions (some with and some without clear reference points for truth) that have a major impact on sustainability (Henry, 2009). Henry also pointed out four main challenges of this education type that are understanding complexity, attenuating normative belief and value conflict, linking knowledge with action, and producing new values for Sustainability.

Meanwhile, many authors are likely to use the term "Education for Sustainability" to indicate a type of sustainability education, begun by Huckle and Sterling in 1996. Sterling insists that EFS can not be well-defined as many other educational terms since it is not an agreed set of ideas educators can tack onto existing thinking and practice to allow them to say "we are doing sustainability". When structuring the Education in Change (Huckle and Sterling, 1996, Chapter 2), the authors try to feature EFS by characterizing twelve attributes of contextual, innovative and contructive, focused and infusive, holistic and human in scale, integrative, process oriented and empowering, critical, balancing, systemic and connective, ethical, purposive, and inclusive and lifelong. More specifically, education for sustainability helps people and communities to examine critically the technologies, systems of economic production, cultural systems of reproduction, laws and politics, and ideas and ideologies they currently employ for living with the rest of nature. It also helps them reflect and act on viable alternatives (Foster, 2001; Huckle and Sterling, 1996).

In debate against EFS theory, John Foster (2001) argues that it cannot be instrumental to operational sustainability, cannot be *for* sustainability in that sense, because it is among the essential preconditions of our ability to determine in any collectively intelligent way what is to count as such sustainability. Instead, he introduces "Education *as* Sustainability". What he means, by contrast, is a readiness to understand and undertake living *as* learning - not just a matter of accepting the old platitude that we live and (often somewhat reluctantly) learn,

but a positive, eager commitment to the heuristic creativity of intelligence in encountering each emergent tomorrow.

But then later on, even John Huckle (2006) uses the term ESD and Sterling in his recent 2010 book with colleagues namely *Sustainability Education - Perspectives and Practice across Higher Education*, attaches both ESD and EFS as sustainability education (Jones et al., 2010). Although there are differences in the content (and often in the context), underpinning these labels is a common pedagogical approach which seeks to empower the learner to explore and engage sustainability (see UOG[1]). Since most of the terminology could be interchangeable, I shall use the single common *Sustainability Education* throughout this treatise.

2.1.2 Four Pillars of Education

The world is facing many challenges of sustainable development, especially the dilemma of economic growth and environmental preservation as well as cultural conservation. These new challenges fill the headlines of the papers and fuel heated debates: global warming, ozone depletion, loss of biodiversity, acid deposition, desertification, overpopulation and resource intensive consumption (Schmandt and Ward, 2000). Educational system, in the meantime, functions importantly in collaboration with social and economic development and "Educators will play a significant role in raising awareness for sustainable development across borders and cultures", stated Prof. Janos J. Bogardi of United Nations University (Thompson and Schansker, 2009). Education possess the key role in addressing challenges like poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health, conflict and the violation of human rights. Education must help acquire the values, attitudes, capabilities and behaviors essential for meeting those challenges (Matsuura, 2005). Education for sustainable development, in particular, is critical for promoting sustainable development (UN, 2003) and an indispensable element in every type of society.

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[1] University of Gloucestershire UK Homepage
http://www.glos.ac.uk/about/sustainability/education/Pages/default.aspx

As part of the effort to strengthen the world's sustainability and to cope with emerging challenges, Jacques Delors, who chaired the UNESCO Commission on Education for the Twenty-first Century from 1993 to 1996, points out in the book with his colleagues namely "Learning - The Treasure Within" that in the view of the future, traditional responses to the demand for education that are essentially quantitative and knowledged-based are no longer appropriate. Thus, he recommends and highlights four fundamental types, or goals, of learning: learning to know, learning to do, learning to be and learning to live together. Through this targets, individuals are equipped to seize learning opportunities throughout life, both to broaden his knowledge, skills, attitudes and to adapt to a changing, complex, and interdependent world (Delors, 1996). Four paths of knowledge that all form the whole are

Learning to know *that is acquiring the instruments of understanding* Learning to know presupposes learning to learn, calling upon the power of concentration, memory and thoughts. Its basis is the pleasure of understanding, knowing and discovering. In secondary and especially in higher education, the initial training must provide all students with the instruments, concepts and references that scientific progress and contemporary paradigms make available.

Learning to do *so as to be able to act creatively on one's environment* Learning to do in most of the cases are coupled with 'learning to know', but more closely link to the question of vocational training. It is a matter of preparing someone for a clearly defined practical task in order to contribute to the manufacturing, and more than that, it must equip learners with the ability to communicate, work with others, and manage and resolve conflicts.

Learning to live together *so as to participate and cooperate with other people in all human activities* In the context of prevalent violence with conflicts throughout history, new factors are accentuating the risk, it is highly imperative to devise a form of education which might make it possible to refrain from dissonances or resolve them peacefully by developing respect for other people. Education must take two complementary paths: gradual

discovery of others and experience of shared purposes throughout life, which seems to be an effective way of avoiding or resolving latent conflicts. It is to teach the diversity of the human race and an awareness of the similarities between, and the interdependence of, all humans under a critical condition that one must know oneself first. Learning to live together helps developing empathy at school, that could probably bear fruit in terms of social behavior throughout life. This pillar is sometimes also referred to as Education for sustainable living (Thoresen, 2011).

Learning to be *an essential progression which proceeds from the previous three*
The message is to enable every person to solve his own problems, make his own decisions and shoulder his own responsibilities. Education's essential role seems to be to give people the freedom of thought, judgement, feeling and imagination they need in order to develop their talents and remain as much as possible in control of their lives. The diversity of people's personalities, their independence and initiative, and even the desire to provoke - these are all safeguards of creativity and innovation. The aim of development is the complete fulfilment of man, in all the richness of his personalities, the complexity of his forms of expression and his various commitments.

However, only three years after the theory of education pillars was born, there was seemingly the need of a new element in correspondence to the rapidly changing situation. Several authors have tried to add the "fifth pillar" to form a complete basement of education for sustainable development.

UNICEF added another pillar during its own analytical process, namely *learning to transform yourself and society* (Black, 1999) and was already adopted into ESD by UNESCO (2009). This fifth pillar indicates the work toward a gender neutral, non-discriminatory society; act to achieve social solidarity and international understanding. It reflects a synergy of cognitive, practical, personal and social skills to bring about sustainability (Combes, 2005).

As another argument, the report "Nurturing the treasure: Vision and Strategy 2002-2007" (2003) mentions it is necessary to add a fifth pillar, that is, *learning to change* with the trend of policy and institutional change, and be ready

for a lifelong learning rather than be restricted to basic education. This learning-to-change education must also enable students to push society to change. In sum, there are four kinds of competency to equip with: learning how to learn; critical thinking ability; interpersonal skills; and creativity (Li and Tsai, 2007; UIE, 2003).

In an address given by Minister of Education and Human Resources of Mauritius in 2005, he proposed to go beyond Delors' four pillars and "humbly add that there is a fifth pillar: Learning to live a legacy - which will be of direct interest to teachers, who practice one of the noblest profession so that posterity will always remember that you [*students*] fulfilled your role in the best traditions associated with our profession" (Gokhool, 2005). Although this is merely an idea raised on the occasion of Prize Giving Ceremony at a college in Central Flacq, it should be appreciated with respect to the contribution to the innovative sustainability education, which is still under huge debate.

Additional point of view from U.S. scholars majoring in Education, Hargreaves and Fink (2006) suggest the fifth pillar as *learning to live sustainably*. This involves to respect and protect the earth and its environment, to adopt behaviors and practices that restrain and minimize our ecological footprint on the world around us - without depriving us of opportunities for development and fulfillment. The authors also insist on the coexisting and cooperation with nature whenever possible, rather than always seeking to conquer and control it. The idea reflects the same meaning of the pillar *learning to transform society and change the world* instructed by DESD.

Another labeling is *Learning to live together sustainably* or *Education for Sustainable Living* given by UNESCO. It was stated that "ultimately, the test of the Decade of Education for Sustainable Development will be its capacity to foster educational change and improvement so that, in learning to live sustainably, we learn to live together in peace and in productive harmony with our environment" (Matsuura, 2005).

As to Peter Jarvis, an educational studies expert of University of Surrey, lifelong learning per se has no aims, only those who are its exponents have aims for it and it is these that may be analyzed from a moral and/or political perspective. The latter is much more acceptable than the former, although even this requires at

least one additional pillar. That is a fifth pillar of learning - learning to respect the planet for it is our home and the home of our children and our children's children (Jarvis, 2008, pg. 150, 218).

No matter how the word usage has been changed, it is clear that researchers have been trying to seek for a new phrase to add into the conventional four pillars since they could see the something missing in it. In the context of the world's rapid change and a revolution towards sustainable development, learners should be equipped with a more holistic approach rather than just studying and doing. They need to generate knowledge themselves to achieve higher level of understanding and behaving that could accelerate a sustainable society. The idea of these fifth-pillars is apt to play such a complementary role in the current education.

2.2   Diversity

2.2.1   Define Diversity

"Diversity is an idea without a clear intellectual context. Its background is murky, and the language in which its proponents speak is often misleading" (Wood, 2003).

On an online Diversity Dictionary generated by the University of Maryland, diversity is defined as a situation that includes representation of multiple (ideally all) groups within a prescribed environment, such as a university or a workplace and considered as an emphasis on accepting and respecting cultural differences by recognizing that no one culture is intrinsically superior to another underlies the current usage of the term. This message already involves a very inclusive denotation of the term, but let us have a look at previous study to see what dimensions of diversity have been considered.

Diversity is defined according to its circumstance. Diversity is sometimes seen as biodiversity "Diversity, particularly biodiversity, is still largely considered in

terms of endangered species, with emphasis on large and exotic animals in distant places. However, habitat preservation is more firmly established as a supporting concept in maintaining biodiversity" or "Diversity is still seen largely as a matter of biodiversity, with more emphasis now on the maintenance of habitats that will sustain diverse animal and plant populations" and ethnic diversity as well (Gayford, 2009, Understanding in relation to the eight doorways).

In the context of a workplace, there are another ways to approach diversity. As a matter of fact, many researchers have conducted research on the effect of group diversity on the outcomes (such as team productivity) (Thatcher, 1999; Williams and O'Reilly, 1998). Sonnenschein (1997) defines diversity in his book simply as significant differences among people, and concentrates a bit more on race, culture, gender, sexual, orientation, age and physical abilities. Other definitions include differences in ethnicity, nation of origin, class, religion, learning, communication styles, where people come from, and occupation as aspects of diversity. More or less alike, with regard to the working environment, Robin Ely from Harvard Business School collected and analyzed data to investigate the relationships between work performance and four commonly studied dimensions of diversity - tenure, age, sex and race (Ely, 2004). Two schools of diversity are set up as visible characteristic, including, for example, sex, gender, age and informational characteristics, which are educational background or years of work experience (Thatcher, 1999). This is made clearer by Dietz (2009) that the current "recipes" of diversity management include not only "visible" markers of an individual's identity - supposedly race, ethnicity, religion, gender or disability, but also non-perceivable sources of diversity such as life styles, value orientations, autobiographical features and personal or professional perspectives, all of which are to be promoted in terms of creating not equality, but an inclusive environment. This definition could also be applied in education field.

Learning diversity is crucial in schools, especially in vocational institutes for doctors, nurses, architect, teacher - they need to understand the diverse cultural background of their clients. In education researches, diversity is often assumed to be about who goes to school/university, where means students of various national origins, or various racial origins, or of various class origins, all attending standard, state-sponsored institute (Winchester, 2002). In another

case, diversity is operationally referred to the special circumstances of women, gays and lesbians, and people with disabilities (Piland et al., 2000) when authors work on learning experiences in courses with multicultural and diversity content. Anderson et al. (1998) discovers diversity by understanding the issues of culture from racial, ethnic and disability perspectives, as preferred by quite a number of American authors. All dimensions of diversity can be reflected in university context, depending on how the meanings are used for each research purpose.

To sum up, diversity in schools could be the heterogeneity in age, sex, race, class, nationality, religion, and knowledge. However, in this research context, the diversity of culture and discipline in education of sustainability are targeted. When using the word "culture", we imply most layers of it, including a national level according to one's country, a regional/ethnic/religious/linguistic affiliation, gender level, generation level, social class level and organizational level (Hofstede, 1991, pg. 10). Besides, it should be noted that research objects do not express grand differences regarding age and sex. The other aspect is background knowledge, or what significantly impacts on the way of thinking in academic environment in higher education. This point is somehow related to the idea of "classroom diversity", which is a form of diversity experience with learning about diverse people (content knowledge) and gaining experience with diverse peers in the classroom (Gurin et al., 2002). Consequently, these two aspects could cover the major perspectives of diversity that might impose any influence on the education.

2.2.2 Impact of Diversity

Diversity is widely recognized to be of great positive impact on the development of a system. As part of that, cultural diversity widens the range of options open to everyone; it is one of the roots of development, understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence (UNESCO, 2002). It is true that knowing about differences can help to avoid conflict in international management (Hofstede, 1991).

Diversity means differences, and differences create challenges, but differences also open avenues of opportunities, it (Sonnenschein, 1997)

- enables a wide range of views to be present in an organization, including views that might challenge the status quo from all sides;

- focuses and strengthens an organization's core values;

- is instrumental in organizational change;

- stimulates social, economic, intellectual, and emotional growth; and

- helps an organization understand its place in the global community.

Proving with a case study of 486 samples, Ely (2004) testifies that heterogeneous groups are likely to be more creative, make higher-quality decisions, and perform better than homogeneous groups (Ely, 2004; Wanous and Youtz, 1986). Concerning both race and sex diversity: these dimensions of diversity appear to have neither a net positive nor a net negative effect on performance in field settings of this kind. In a simulation study of MBA students, in groups with a collectivistic culture that valued teamwork, and rewarded cooperation and team performance, diversity and nationality, sex, and race was more beneficial to performance than in groups with an individualistic culture that valued individual effort, and rewarded competition and individual performance (Chatman et al., 1998; Ely, 2004).

However, not all literatures point out that diversity has positive impact. In Thatcher's research (1999) on the impact of relational demography and team diversity on individual performance and satisfaction, he concludes that being different on visible characteristics causes some dissatisfaction (sex and race), lower levels of perceived employee performance (race), and lower levels of objective performance (age); moreover, the degree to which the outcomes were negative increased with higher level of team diversity.

Sometimes, diversity is treated not as an educational opportunity but as the educational enemy, especially if the diversity of too great (Winchester, 2002).

> *Diversity has damaged education in much more far-reaching ways by creating incentives to trim or eliminate academic requirements,*

standards and expectations... The damage that diversity does to higher education in this sense is profound. Not only does it bring students to campus who have little possibility of success measured by real standards, but it also prompts the colleges and universities, day in and day out, to lie about their practices (Wood, 2003).

Within a system, diversity plays a number of roles, with either positive and negative effects. Nevertheless, in the framework of sustainability education, the positive functions of diversity are highlighted and supposed to be proven in this study.

2.3 Relationship between Sustainability Education and Diversity

Why sustainability education and diversity have a linkage to each other and how they bridge together? How is this implicitly shown in previous studies? These questions would probably be answered in this section through the help of the concept "transdisciplinary".

2.3.1 Sustainability Education and Transdisciplinarity

The new trend and type of education, as described in the first section of this chapter, must meet the requirements of sustainable development. Sustainable development and ESD face broad and encompassing challenges that require contributions from many disciplines (McKeown et al., 2006). 'Many disciplines' reminds us of three popular ways of wording: Multidisciplinary (or Pluridisciplinarity), Interdisciplinary and Transdisciplinary.

Multidisciplinarity concerns studying a research topic not in just one discipline but in several at the same time. While interdisciplinarity concerns the transfer of methods from one discipline to another and its goal still remains within the framework of disciplinary research, transdisciplinarity concerns the dynamics

engendered by the action of several levels of Reality at once - the discovery of these dynamics necessarily passes through disciplinary knowledge. All of the four, including Disciplinary, are like four arrows shot from but a single bow: knowledge (after Nicolescu, 2005).

> *Multidisciplinary research refers to a topic lying transversal to the disciplines. Different disciplines work on its different aspects with their respective methods. Afterwards, these partial results may be connected additively in order to display the diverse facets of the topic. Interdisciplinarity means cooperation among different scientific disciplines and the "integration of different disciplinary perspectives, theories and methods... Transdisciplinarity refers to "cooperation with experts in possession of practical experience from outside the academic world* (Godemann, 2006).

To simply distinguish, while multidisciplinarity and interdisciplinarity do not crack the disciplinary thinking, transdisciplinarity does. As stated by Ramadier (2004), transdisciplinarity breaks it away in a significant way, since the objective is to preserve the different realities and to confront them. He introduces the argument that transdisciplinarity is at once between disciplines, across disciplines and beyond any discipline, thus combining all the processes of multidisciplinarity and interdisciplinarity (Lawrence and Despres, 2004). The two latter expressions are trying to combine or collaborate disciplines whereas the first suggests a higher level of alliance which could cross over any types of border.

Back to the characteristics of EFS, one of them is "Integrative", which emphasizes on interdisciplinary and transdisciplinary enquiry, reflecting that no subjects, factors or issues exist in isolation. Transdisciplinary here means breaking free of disciplinary perceptions and traditions to create new meanings, understandings, and ways of working (Huckle and Sterling, 1996, Chapter 2). Of course, transdisciplinary is not sum of the parts, meaning simply putting disciplines together.

An education in sustainability has the capacity of increasing awareness of the complexity and interrelationships of environmental, economic, social, political and technical systems. This can be achieved via a transdisciplinary

approach to teaching and learning, which could provide transdisciplinary skills that cross disciplines, cultures, and institutions (Padurean and Cheveresan, 2010). Transdisciplinarity in education for sustainability is recommended to base on the four pillars of education in the 21st century, in which stress on the role of university education. According to the World Declaration on Higher Education for the 21st Century (1998), higher education is facing a number of important challenges at the international, national and institutional levels (UNESCO, 2009), which are

- Changes in universities as institutions and at the level of internal organization. These changes should aim to improve the management of resources (human, economic, etc.) and be restructured to improve internal democracy. Universities must continue their mission to educate, train and carry out research through an approach characterized by ethics, autonomy, responsibility and anticipation.

- Changes in knowledge creation. Interdisciplinary and transdisciplinary approaches should be taken and non-scientific forms of knowledge should be explored.

- Changes in the educational model. New teaching/learning approaches that enable the development of critical and creative thinking should be integrated. The competencies common to all higher-education graduates should be determined and the corresponding expectations should be defined. In a knowledge society, higher education should transform us from disoriented projectiles into guided missiles: rockets capable of changing direction in flight, adapting to variable circumstances, and constantly course-correcting. The idea is to teach people to learn quickly as they go along, with the capacity to change their mind and even renounce previous decisions if necessary, without overthinking or having regrets. Teaching and learning must be more active, connected to real life, and designed with students and their peculiarities in mind.

- Changes aimed at tapping the potential of information and communication technologies in the creation and dissemination of knowledge. The goal of such changes is to create what Prensky (2009) calls *digital wisdom.*

- Changes for social responsibility and knowledge transfer. The work of higher-education institutions must be relevant. What they do, and what is expected of them, must be seen as a service to society; their research must anticipate social needs; and the products of their research must be shared effectively with society through appropriate knowledge-transfer mechanisms.

This means inter- and trans-disciplinary approaches act as key players in reforming the higher education system and yes, the cardinal points for successful sustainability education are student focus engagement in real environmental issues, improved transdisciplinary approaches and curriculum reform (Pearson et al., 2005).

2.3.2   Transdisciplinarity, Transculturality and Diversity

In parallel with *transdisciplinarity*, another newly developed term namely *transculturality* exists. Not so much alike the approach to the former concept, no meticulous explanation about it as reported by van Dam-Mieras et al. (2008). All three *multi-, inter-, and transculturality* are employed in the paper and generally be considered as the collectives of cultures, or similarly correspond to the meanings of those of *disciplinarity*. *Intercultural* is used more popularly, and if we refer to a more familiar *cross-cultural*, it will set our mind at better ease.

As above investigated, either transdisciplinarity or transculturality and diversity have the same core interpretation. Diversity in schools brings differences, dissimilarities together to enhance the interaction among students, to promote communication and henceforth, promotes *learning to live together*. Moreover, a diverse environment creates transdisciplinarity a better environment to execute and to glow.

Although many educators agree that a holistic, transcultural learning environment is desired and needed in colleges, very few research has been

conducted to determine how much of this education students are actually getting in the classroom. More important, however, is the fact that students' responses to multiculturalism and diversity should also be considered (Piland et al., 2000). It should be noted that across these different approaches and different samples of students and faculty, researchers have found similar results showing that a wide variety of individual, institutional, and societal benefits are linked with diversity experiences (Gurin et al., 2002). Needless to say, the impact of diversity on learning is believed to be especially important during the college years because students are at a critical developmental stage, which takes place in institutions explicitly constituted to promote late adolescent development (Gurin et al., 2002). As yet, discussions have been centering more in racial and ethnic diversity. Thus, the question 'what is the role of diversity in sustainability education and how do the transdisciplinarity and transculturality promote sustainability education?' remains mal-answered.

Chapter 3

Methodology Review

3.1 Qualitative Research

Doing a sustainability science research and focusing on the education perspective, what is the best methodology to apply? As a glance at the background, educators have used *scientific* method, which is a systemic way of testing hypothesis and determining cause/effect, using quantitative data to examine and present results. Others include *experimental research, traditional paradigms, foundationalist paradigms, positivism* or *traditional research paradigms* (Lichtman, 2010). Qualitative research gave affiliation to people in the 1970s, 1980s and in the 1990s shifts in the field began pulling adherents apart - educational researchers have been pioneers and leaders in spreading qualitative research into applied areas (Bogdan and Biklen, 1998).

Methodology used for this study is to be discussed, and detailed methods will be included later in each case. A short clarification for the differences between *Methodology* and *Method* is provided. Synthesizing from readings, King (1994) helps us to do that by saying, *Method* is technique for or way of proceeding in gathering evidence while *Methodology* is a broader and larger way of viewing patterns of the whole; but we should not look at them separately. A group of *Methods*, such as surveys, interviews, observations, must reflect a *Methodology*.

Bogdan and Biklen (1998) point out the two major types of qualitative research, which are (1) participant observation- fieldwork/naturalist where data is gathered in a natural environment which engaged natural behaviors and (2)

in-depth interviewing with open ended questions used to get as many details as possible. Qualitative research, as Merriam (1998) explains, is to understand the phenomenon of interest from the participants' perspectives, not the researchers, which is sometimes referred to as the *emic* - insider's view. The researcher is the main instrument for data collection and usually involves fieldwork, primarily employs an inductive descriptive research strategy. Different from a deductive approach, conclusions are commonly derived from the initial observations or data through hypotheses and clarifications. The goal of a qualitative research varies: some researchers look for grounded theory, or description, or a better understanding of human behavior and experience; some seek to empower and change. Qualitative research should be naturalistic, descriptive data, concern with process, inductive, and meaning (Bogdan and Biklen, 1998). Qualitative and Quantitative method can be used together but very challenging.

Qualitative research as a field did not exist in education before 1980s, featured itself by ethnographies in schools by anthropologists. But no more than 20 years later, it seems that almost everything can be labeled qualitative research, not excluding educational researchers (Lichtman, 2010). Nowadays, qualitative research in education is so popular that dozens of handbooks are designed to help researchers and educators manage this methodology such as *Qualitative Research in Education: A User's Guide* by Lichtman (2010) with two editions, *The SAGE Handbook of Qualitative Research* three editions, *Qualitative Research for Education - An introduction to Theory and Methods* by Bogdan and Biklen (1998) three editions, or the 49 volumes in Applied Social Research Methods Series. This is to confirm that educational research would better employ this type of methodology for its own strengths.

Bogdan and Biklen 1998, chap. 1, show us a whole picture about distinct characteristics of quantitative and qualitative research. From that, it could be roughly determined if we are actually doing a qualitative research or not. *Case study* is definitely among the qualitative approaches but *social facts*, which will also be revealed, are part of quantitative study. We are going to *show the relationship between variables* but not so robust that is able to generate a concrete trend. Though existing in a very small number, quantitative data are covered along with *descriptions*, *personal documents*, or *field notes*. The questionnaires, in

particular, use both observation and survey research as well as interview and open questions. Henceforth, this research could also be considered as the first type of what brought up by Bogdan and Biklen (1998), yet using a mixed methodology (see Tashakkori, 2006), combining the qualitative and quantitative approaches into the research methodology of a single study or multiphased study.

3.2 Case Study

Case-study methodology is a common and appropriate research tool used in studies of sustainability in higher education (Corcoran et al., 2004). Case study is another approach to qualitative research (Lichtman, 2010), in addition to *Narrative Analysis, Discourse Analysis, Biography, Auto-biography, Narrative Storytelling Analysis, Life History* and so on. Case study is intensive, holistic description and analysis of a single unit or bounded system; qualitative case studies in education are often framed with the concepts, models, and theories from anthropology, history, sociology, psychology and educational psychology (Merriam, 1998).

A case study is an empirical inquiry that investigates a contemporary phenomena within its real life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1994). Case study can be seen to satisfy the three tenets of the qualitative method: describing, understanding, and explaining - it can be single or multiple-case designs, where a multiple design must follow a replication rather than sampling logic (Tellis, 1997). The differentiation between single case and multiple case design is made referred to Rowley (2002). A single case design is akin to a single experiment. Single case studies are appropriate when the case is special (in relation to established theory) for some reason. This might arise when the case provides a critical test to a well-established theory, or where the case is extreme, unique, or has something special to reveal. Single case studies are also used as a preliminary or pilot in multiple case studies but somehow multiple designs are preferred.

Rowley (2002) also analyzes three factors that determine the best research methodology, which are the types of questions to be answered; the extent of control over behavioural events, and the degree of focus on contemporary as opposed to historical events. Among those, the way we choose the questions and consequently, the answers obtained play a significant role in developing a sound case study. In exploratory case studies, fieldwork, and data collection may be undertaken prior to definition of the research questions and hypotheses. Explanatory cases are suitable for doing causal studies. Descriptive cases require that the investigator begin with a descriptive theory, or face the possibility that problems will occur during the project (Tellis, 1997).

Robert Yin (Tellis, 1997; Yin, 1994) recommends the use of case-study protocol as part of a carefully designed research project that would include the following sections:

- Overview of the project (project objectives and case study issues);

- Field procedures (credentials and access to sites);

- Questions (specific questions that the investigator must keep in mind during data collection); and

- Guide for the report (outline, format for the narrative).

Besides, he develops six sub-methods for a case study that are Documents, Archival Records, Interviews, Direct Observation, Participant-observation, and Physical Artifacts. Those sources of evidences for case studies, as reported by Tellis (1997), are also mentioned in *The art of case study research* by Robert E. Stake one year later. Documents could be letters, memoranda, agendas, administrative documents, newspaper articles, or any document that is germane to the investigation. Archival documents can be service records, organizational records, lists of names, survey data, and other such records. Interviews are important sources of case study information. There are several forms of interview that are feasible: Open-ended, Focused, and Structured or survey. Direct observation occurs when a field visit is conducted during the case study. Physical artifacts can be tools, instruments, or some other physical evidences that may be

collected during the study as part of a field visit. Participant-observation makes the researcher an active participant in the events being studied.

Case studies, especially qualitative case studies, are prevalent throughout the field of education (Merriam, 1998, pg. 26, 37). She confirms that what makes these case studies in education is the focus on questions, issues and concerns broadly related to teaching and learning. Case studies in education might be descriptive, interpretive, or evaluative. This work is more of an evaluative case study which associates description, explanation and judgement. Case study is appropriate when the objective of an evaluation is to develop a better understanding of the dynamics of a program that could convey a holistic rich account of an educational program (Kenny and Grotelueschen, 1980; Merriam, 1998).

3.3 Strengths and Limitations of the Methodology

Historically, there has been a heavy emphasis on quantification in science when Mathematics is often termed "the queen of science" (Denzin and Lincoln, 1994, chap. 6) and it is rather tough for "soft" approaches to be employed. Criticisms involve biases from researchers' opinions and prejudices, unconvincing conclusions, time-consuming, unstandardized procedures and difficult to study a large number (Bogdan and Biklen, 1998).

Qualitative research seems to be so appealing just because we do not need to work with tables, numbers and statistics but it is really easy to get into ambiguity, confused structure and word-finding difficulties (Lichtman, 2010). In a qualitative research, some ethical requirements, for instance privacy, anonymity, or confidentiality, are critically kept; but then the audience may probably cast doubt on the acquired data and the interpreted results. Qualitative research, besides, can not either control and predict the trend of the population or produce precise findings (see Merriam, 1998).

However, qualitative data can redress that imbalance [*that is the applicability only in other similarly truncated or contextually stripped situations caused by quantitative data*] by providing contextual information. Furthermore, it could provide rich insight to human behavior and be useful for uncovering insider's view (Denzin and Lincoln, 1994). When studying about historical flows, it could cover truths and produce sharp criticism – these strengths even play more important roles in conducting researches on education. Case study research contributes to practice by improving the reasoning of practitioners (technical, normative or, preferably, both) (Corcoran et al., 2004).

Case studies as a research method or strategy have traditionally been viewed as lacking rigor and objectivity when compared with other social research methods, but in fact are widely used because they may offer insights that might not be achieved with other approaches (Rowley, 2002).

Case study is a valuable method of research with distinctive characteristics that make it ideal for many types of investigations. It can also be used in combination with other methods. Its use and reliability should make it a more widely used methodology, once its features are better understood by potential researchers (Tellis, 1997). The researcher selects a case study design because of the nature of the research problem and the questions being asked (Merriam, 1998). Although has to tackle with issues of reliability, validity, and generalizability, case study is a particularly appealing approach for applied field of study such as education. Therefore, it is quite partial to say that which method is better without looking at the certain context and demand of current situation.

Our work is trying to surmount those nature limitations by integrating the quantitative data as stated above. The complements partly solve the predicament of being too subjective in deducting the phenomenon. More specific methods are to be thoroughly described in each of the following cases.

Chapter 4

Case Study One: Short-Term Education

4.1 Intensive Program on Sustainability

4.1.1 General

Origin Intensive Program on Sustainability is a collaboration scheme between the Asian Institute of Technology (AIT) and The University of Tokyo. The program accepts students from all over the world and is designed to provide the students with exposure to a crosscultural and multidisciplinary environment and the opportunity to intensively discuss sustainability (Onuki and Mino, 2009). Starting from 2004, IPoS is an short-term educational program for students to obtain deeper understanding about Asian and global sustainability and to work out sustainable solutions for some specific topics and contexts. This event is supported by AGS (Alliance for Global Sustainability)[1], I3RS (Integrated Research System for Sustainability Science)[2] and Nissan Science Foundation for fostering future leaders in the region. Apart from the overall goal, the program also aims at strengthening the linkage among the sustainability education network members and cultivating friendship across nationalities and

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[1] For more information about AGS, please visit http://globalsustainability.org/

[2] IR3S, or SSC, will be mentioned in the next chapter

Morning Assembly

Field Visit to Yokohama

Work Group Outcome

Lecture

Figure 4.1: Nissan Workshop in IPoS in December 2010

academic background. Accordingly, as a fruitful result, ANIPoS[1], the alumni community of all IPoS-ers, has been developed and operated very actively so far.

Theme Two terms are held annually: Summer term, which is called as (main) IPoS and Winter term (also referred to as Nissan workshop) launched first in 2006. Until now, there are 11 sessions (extracted from IPOS Homepage) taken place repectively in Thailand and Japan, each of those lasts for around 10 days to two weeks. Topics vary from food/energy safety, regional development, sustainable transportation, etc and the topic of "Sustainable Livelihoods through Integrative Practices with Emphasis on Food, Water and Sanitation in a Peri-urban Community" is going to be set for this year's IPoS 2011 in Thailand. This case study was conducted during the Nissan Workshop in IPoS 2010 titled "Sustainable Cities and Mobility in 2050" located in Kanagawa prefecture of eastern Japan.

Program IPoS is a comprehensive program with lectures, workshops, group

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[1] Homepage http://www.anipos.org/

works, field visits, field work and also inevitable activities created by students. Nissan Workshop 2010, in promoting the subject "Sustainable Cities and Mobilities in 2050", guided students with two keynote lectures on sustainability and sustainable cities & transport by distinguished professors from The University of Tokyo. Following up were seven modules integrated by group working. One day excursion to Yokohama, one to Nissan Factory and another for field survey with locals in Shonan village were part of the outdoor activities. Day time was almost covered by the classroom schedule and evening time for self group working. Including the morning assembly, when all members got fresh by learning some cultural movements, a day in IPoS was set routinely from 8:30am to 10pm. This is as well typical of IPoS, which is truly called 'intensive program'.

4.1.2 Participants

Eligibility Conventionally, eligible participants should belong to The University of Tokyo, AIT, AGS[1] or IR3S[2] partners. However, IPoS organizers every year still spare some positions for worldwide students in connected institutions[3]. Selection procedures depend on every institution but applicants most probably need to submit an application and pass an English-based interview. A qualified candidate is at least be able to communicate in English and has certain concerns about the environment or sustainability, no matter from what discipline he or she based.

Conditions Every year a group of approximately 30 students from many countries in the world gather twice in the two sessions. Year 2010 was an exception, due to the political instability in Bangkok, summer IPoS had to be canceled although candidates were already called for. As a consequence, unlike earlier years when winter term was considered as a reunion, Nissan Workshop 2010 was the first time for members to get acquainted with one another.

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[1] AGS partner universities: MIT, ETH Zurich and Chalmers Institute of Technology

[2] IR3S group: Hokkaido University, Ibaraki University, The University of Tokyo, Kyoto University and Osaka University

[3] Nissan Workshop 2010 involved students from National Cheng Kung University and Australian National University as well

Table 4.1: Overview of IPoS 2010 in Japan

	Main point	including..
Content	IPoS 2010 "Sustainable Cities and Mobilities in 2050"	Lecture, field visit, workshop, group work, and other outdoor activities
Participants	28	AGS, IR3S, AIT, UT and other connections
Nationalities	17	American, European, Australian, Asian
Backgrounds	all fields that can contribute to sustainability	social, natural and transdisciplinary based science
Annual Schedule	twice a year	Summer IPoS (Thailand) and Winter IPoS (Nissan Workshop in Japan). Each lasts 10-14 days

During the whole 10 days, all 28 participants, four teaching assistants and coordinators lodged together in a remote village with inconvenient means of transportation to downtown. Most of their communication time were devoted to interact with their colleagues and local people. Spending nearly 14 hours everyday, students had to manage to take lectures, to do group work, to get along with classroom peers and to eventually develop a project related to sustainable cities and mobilities in 2050.

Group work Five groups were determined by the organizers. Group arrangement for the final proposal was chosen randomly under the condition of ensuring the diversity of students and stayed the same throughout the program. However, module's group was changed day by day in order to let students expose to all possible sorts of discussion environment.

4.1.3 Why IPoS?

To iterate, the object of this research is the students in diverse environment, regarding cultural and disciplinary background, who are under the framework of

Table 4.2: Diverse Class in IPoS

Country of Nationality	Field of Study
Japan	Water and wastewater engineering
Thailand	Sustainability Science
Sweden	Forestry
USA	Civil engineering
Bangladesh	Environmental management
China	Urban engineering
Dominican Republic	Environmental system
Switzerland	Food science and Biotechnology
Nepal	Physics
Pakistan	Management of technology
Indonesia	Chemical engineering
Brazil	Agricultural science
Belarus	Electric power system
Germany	Architecture

sustainability education. Looking at the table 4.2, it is obvious to say that this group of students is really heterogeneous.

Not only the cultural bases and study fields are varied, their academic status is also ranging from bachelor, master and doctor year one to three. As people from cultures very dissimilar on the national culture dimensions can cooperate fruitfully (Hofstede, 1991, pg. 237), this group might give a hint for proving the hypothesis. Then let us see subsequently what the situation would be when they together study under the umbrella of sustainability. You could also look at table 4.1 to have an overall picture about our object in this first case.

4.2 Methods and Survey Questions

4.2.1 Methods

There techniques of Case Study Methodology are utilized as following

Observation was conducted from the first day until the closing ceremony, during lecture-based classes or group work. What the researcher did was to take note the activeness of students during sessions, to see how dynamic the class was and what factor affected their behaviors.

Questionnaire was designed online and sent to 28 members after they finished the program. This would enable them to have the most objective and thorough assessment about the time they experienced. Questionnaire was short and concrete; besides, it was uploaded to the website conveniently in order to attract the best possible number of respondents. (See Appendix for the detailed questionnaire)

Interview During the entire program, the researcher conducted informal talks with some of the IPoS participants. Those interviewees were illustrative enough to represent the group of diversity. Interview is freestyle and goes with the talk flow to reveal deep thoughts of respondents, but still focuses on the main objective of the study.

4.2.2 Instruments

Surveymonkey Survey monkey[1] is an online questionnaire tool where users can design their questions on a website and retrieve results by downloading a spreadsheet file. There are 15 question types, including multiple choice, matrix, comment box, demographic information, image and so on. Surveymonkey also helps researchers to arrange and preliminary analyze the data based on the target of each survey. Options of managing responses are assorted, registered members can set max response count, set a cut-off time

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[1] www.surveymonkey.com

and date, and create a number of collectors. Computer's ID of respondents and date of filling questionnaire are also cached.

Excel SpreadSheet Answers are sent online, directly to webpage's storage. After loading to the working computer, depending on the purpose and type of results (whether it is under the form of summary, condense or full answer), researcher starts using Microsoft Excel 2007 program to conduct analytical works. Given that the study population is not so big for resorting to a professional statistic program like STATA or SPSS, in this case Excel is strong enough to deal with information.

4.2.3 Research Questions

Survey questions

- Where do you gain the new knowledge on sustainability from?

- Students of IPoS2010 create a study and work atmosphere. How does this environment benefit your studies of sustainability?

- What difficulties/gaps have you found during lectures, group work and outdoor activities? How much do these difficulties/gaps reduce your expected productivity?

- Is this environment too diverse or not?

Semi-structured interview As stated above, interview questions are quite perceptually, but still center at some core points, such as

- How diverse are the students in sustainability program of your university?

- How could you get over the difficulties caused by a heterogeneous environment?

- What do you think about the diversity of students for sustainability courses? and so on.

4.3 Key Results

Observations The group consists of 28 members coming from all over the world. Most of them are from Asia (57%) and Europe (25%). Three students are from the America (of USA, Brazil, and Dominica Republic's nationality) and two from Australia. Although The University of Tokyo and AIT are the host institutions, there are only two from Japan and four from Thailand. Others Asian representatives include from China, Taiwan, Pakistan, Nepal, Indonesia, Bangladesh, and Malaysia. With another seven students from Sweden, Switzerland, Germany, and Belarus, the number of nationalities over the whole population is 17/28 ($\sim$60%).

With respect to academic level, one bachelor candidate (which is the only flexible exception), 19 masters and eight PhD students majoring in different research fields make up the multidisciplinary class. If roughly classify, the students from natural-oriented science (physics, engineering, technology management, electric power system...) are twice as many as those from social fields like life science or agricultural science. Five are studying in sustainability-related areas, which are also understood as transdisciplinary science.

As from observing the students' activeness during 12 in-class sessions, there were a total of 232 times when students brought out their opinions to share with classmates or instructors (see figure 4.2). This means each participant retained an average of 0.7 time speaking in one lecture. However, it is not the same to all members: although Asians outnumber the gross rest of the class, their opinions occupy only 41%. Each Eastern student commonly owns six times of raising their hands on average during the entire program while that of American and European participants is respectively 14 and 11. Reasons for this dynamics are students being (i) directly asked by the lecturer, (ii) stimulated by questions, and/or (iii) self-motivated. The discussion often started when one expressed what he/she thought apropos of lesson's content or the instructor raised some intriguing questions. In response to the presenters' queries, 100% first immediate reaction were from

Region	Participation (%)	Activeness	Average	Initiate discussion
Asia	16 (57.1%)	95	5.94	13
Europe	7 (25.0%)	79	11.29	29
America	3 (10.7%)	42	14	11
Australia	2 (7.1%)	16	8	2
Overall	**28 (100%)**	**232 times**	**0.7time/day/st**	**55 discussions**

Figure 4.2: Observation from the Case of IPoS

Western students. Over 55 discussions, solely 23.6% were initiated by Asian members.

Questionnaire 27 out of 28 individuals of the population joined the questionnaire, reached 96.4% response rate. Following each question, we got answers as such

(1) *New knowledge on Sustainability* When letting students choose from which source their new knowledge on sustainability was originated, an average of 40% goes to the choice of "from Professors (with lectures and modules)", 36% from friends and 24% from their self efforts (the total must be 100%). The amplitude of second choice is large but from at least 5% to 80% whereas the bottom value of the other choices could go down to 0%. Respondents are most likely to determine that one fifth of the knowledge were originated from the own exertion (Mode value is 20%).

(2) *Benefit for Studies* Five components of sustainability education are raised: system thinking, critical thinking & reflection, ideas for change, participation, and future planning; so that participants could judge how the class composition impacts on each aspect. Choices range from zero to five where the highest number tells the benefit is high and zero indicates negative influences. Acquired data report no negative impact on students' studies of sustainability due to their diversity. Furthermore, the lowest evaluation is 3.81, which means in between "somewhat" and "much" benefit, for system thinking competency. Data as well show that students put high weigh for participation skill, convinced by that 48% of respondents chose
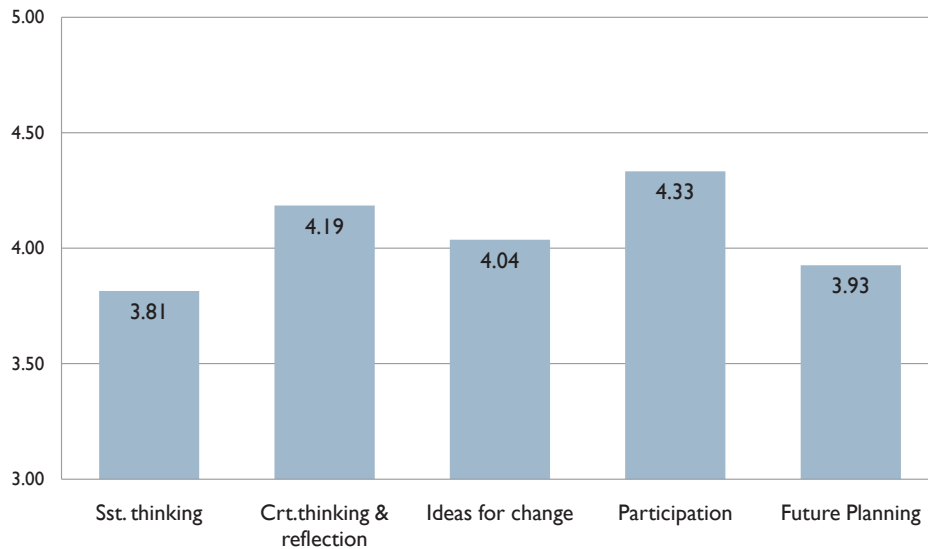
Figure 4.3: How do classroom peers benefit your studies of sustainability?

number five - "benefit very much (to their education)". Besides, diverse environment of fellow students also improves "much" the critical thinking after the program. Figure 4.3 illustrates this result.

(3) *Difficulties or gaps & Productivity reduction* Not all answers state that difficulties or gaps exist (figure 4.4). During outdoor activities, over 50% of members do not have any obstacles at all except tiny conflict among group members. Nevertheless, in lectures and especially during group work, a number of difficulties should be noticed. Language skills and communication are among the iterative troubles, prevent learners from understanding clearly the transmitted information in presentation and talks. The wording "language barrier", "English" or "accent" shows up in about 30% of criticisms on lectures and 7/26 comments on group working. Problems from differences between social and natural oriented researchers, new study approaches, terminology or lacking of pre-knowledge on sustainability are also remarkable. Cultural and personality gaps are mentioned, but limited at around 15% of annotations.

Comments "It was sometimes difficult when people had very strong views

Lectures	Group work	Outdoor activities
Knowledge are new	Language skills and communications	Time lacking
Distraction	Strong characteristics	Language barrier
Not enough time	Strange or new term/concept	Different point of view
Background different	Different background	Group member conflict
Language	Consensus making	Reluctance
Taught before	Work ethics	
Complicated concepts	Cultural aspects	
No need	Strong leader	
Response rate		
(81%)	(96%)	(48%)

Figure 4.4: Difficulties during Sessions

and were not willing to listen to other people's ideas and comments. ie. they only thought that their views were acceptable" or "Consensus making and equal participation of all members", "language problems, definition misunderstandings" are among the opinions deriving from student's own experiences.

Concerning about how much their productivity reduced due to those hindrances, the feedback are widly ranged: three students state that their productivity was fully reached (reduction is zero) while another two point out their overall lessen in effectiveness of IPoS was up to 80-90%. After a simple calculation, about one third of each individual's efficiency is lost because of the unsmooth connections with other participants.

(4) *Intensity of diversity* The last question investigates overall thoughts about peers in IPoS in the sense that they come from different cultures and various backgrounds, which might be totally conflict with one person. Again, the ranking is from 1 to 5, where 1 implies this diversity is too much that one may not be able to adapt himself and get the best study outcomes as expected. Analysis discloses an coincidence: the average, mean

and mode value of data range is pretty much the same. The major research population affirm that they think such diversity is "normal and it is good for studying".

Explanation "It is a chance for sharing idea, gaining idea from different cultural people/background" (an Ibaraki PhD student); "I have always lived in a multicultural environment and I am very used to working with people from different cultural backgrounds" (a Taiwanese who had been gone through American undergraduate education) are among common positive remarks. More critical evaluations are "Diversity is necessary, but there should be a base upon which all could start discussion. And since our purpose is to contribute to sustainability with an academic point of view, our basic platform of discussion ought to be to build scientific knowledge through a clear methodology of research. If one lacks that it is difficult to start any discussion" and "It was good but the team leader or team members need to be more organised in equal input."

Interview Reporting on how diverse sustainability program in their universities is, those who are of America/Europe-pertained education confirm that it is not uncommon to see many classes with about 70% students from all over the country and the rest from Asia. However, a German Master's student "feel strange and new with so-called real Asian people" because in her point, Asians who go abroad to study is somewhat dissimilar" and no classes to date were claimed to be as diverse as in IPoS.

About "*What is the problem with diversity?*", "I appreciate the diversity among students, but confess that sometimes results can not be churned out for being too various in terms of ideas. Students have to either agree on an issue that they are not really happy with or continue to discuss forever since they are looking at the problem from their own point of view differently" recalled a US PhD student.

"It was sometimes difficult when people had very strong views and were not willing to listen to other people's ideas and comments. ie. they only thought their views were acceptable" an Australian Bachelor student said.

"As for myself, I always like the diversity in any environment that I involved in, thus this will not bother me much. But it was always a challenge to get used to the environment, but it was not much of a hassle" a Malaysian Master's student told us.

and "*What should be definitely removed in order to have best learning outcomes?*" "I can not work with a huge gap between academic background and language skill. Differences are fine, but you must understand at least the basic level of basic things in science. Otherwise it's impossible to communicate". For a short conclusion, we cite here a concrete comment of an ETH student, who gave a Four assessment, "Diversity is good but costs time".

Chapter 5

Case Study Two: Long-Term Education

5.1 Japanese Universities with Sustainability Courses

Brief general features of Japan educational system is to be presented, adopted from three editions of *Introduction to Japanese Society* of internationally renowned scholar Yoshio Sugimoto[1]. In Japan, each child has to enter primary school and then proceeds to three-year middle school as a must. Though the proportion of completing 12 years of schooling is very high (98%), just over half of them move on to higher education. Thus, we can see university-educated Japanese is a minority despite the implication that one's educational qualifications may influence one's long-term monetary rewards. Those who have strong desire to enter universities and succeed in the entrance exams are assumed to have sound academic motivation, be infused by parents' robust concern (including their educational background) with financial support and be supposed to achieve higher raking jobs, conditional upon the university's reputation. Public national universities are always considered to be prestigious, have tough entrance

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[1] Yoshio Sugimoto is Professor of Sociology at La Trobe University, Melbourne. He graduated from Kyoto University, Japan, and obtained a PhD in sociology at the University of Pittsburgh, USA.

exams but open more opportunities for students to seize good jobs. The examination-oriented culture of Japanese education, in which pupils face intense competition in all stages of their life, equips college student with elaborate capacities to memorize facts, numbers, events, to solve mathematical and scientific equations while attaches little importance to the development of creative thinking, original problem formulation and critical analysis in the area of social issues and political debates. One irony of Japan's education scene lies in the sharp contrast between stringent, military-ethics based schools and slack universities so that many students regard university life as 'moratorium' or 'leisure land' and do not see it as a value-added process for enhancing the qualifications. Once one is admitted to a university, he rarely fails to graduate from it.

College programs have been quite homogeneous in language usage. Most of the courses are carried out in Japanese language and before 1983 (Umakoshi, 1997), there were a strictly limited number of foreign students in Japanese institutions. Regarding students who wish to study at Japanese universities and colleges, command of the Japanese language is supposedly a prerequisite. The curriculum set by the Ministry of Education dictates that pupils should be taught to speak standard Japanese[1]. Nowadays' trend figure out the neo-liberal approach to education, which favors market-driven elite education and must introduce more student-centered, innovation-oriented, and problem solving programs[2] and interdisciplinary subjects. The tendency of internationalization is getting more prominent, indeed, as of 1992, the number of overseas students studying in Japan has surpassed the level of 45,000 (Umakoshi, 1997). Concerning sustainability contents, recently, ESD has been incorporated more clearly in Japans school education system (Kitamura and Hoshii, 2010). This is reflected by the *Basic Plan for the Promotion of Education* published by MEXT in 2008. According the authors, not only schools but also some academic associations like Japan Society of Environmental Education, the Japan Association for International Education and the Japan Society for Science Education (who has a special working group on ESD) are contributing to promote ESD in Japan.

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[1] Sugimoto, 2nd edition 2002

[2] Sugimoto, 3rd edition 2010

One active group consisting of top universities in Japan which has been operating progressively towards sustainability since 2006 is IR3S or SSC. The Integrated Research System for Sustainability Science (IR3S)[1] was formed in order to create visions leading to global sustainability and a super-transdisciplinary academic area called Sustainability Science. The program ended in 2010, and the Sustainability Science Consortium (SSC) was established as the succeeding organization in September 2010 (GPSS, 2011). In this research, IR3S and SSC is equally used as referred to the identical group.

SSC is composed of five major universities: The University of Tokyo, Kyoto University, Osaka University, Hokkaido University and Ibaraki University. Besides, there are Toyo University, the National Institute for Environmental Studies, Tohoku University, Chiba University, Waseda University, and Ritsumeikan University acting as cooperating institutions. In each member university of IR3S locates an institute that acts as assistance to the educational program related to sustainability science. Albeit the joint educational program of IR3S was initiated in 2008, member universities started their own a little earlier. Table 5.1 will briefly guide you with overall view on each university's program.

Hokkaido University Hokkaido University, established the Inter-department Graduate Study in Sustainability (HUIGS) in 2008. In addition to the regular subjects on professional education at each graduate school, HUIGS students also take Sustainability Science I and Sustainability Science II as compulsory subjects, along with two subjects selected from Sustainability Science III, Sustainability Science IV and subjects provided by other graduate schools (Kitamura and Hoshii, 2010). Under the Hokkaido University Sustainability Governance Project (SGP), the final academic goal is the establishment of the Graduate School of Sustainability Science, which will help to form the concept of what Sustainability Science is. Students will receive a diploma at the end of the school year, after the successful completion of the credits in the designated course (Sato et al.). In 2010, according to Dr. Tsuji, coordinator of the program, there are about 30 students who take SSC course.

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[1] Homepage http://en.ir3s.u-tokyo.ac.jp/

Ibaraki University[1] The university has it own newly-established program named "Graduate Program on Sustainability Science", which is closely linked to the Institute for Global Change Adaptation Science (ICAS). Started from 2009, it has offered courses and afterwards a "Certificate of Sustainability Science Course/Program". The sustainability science course is operated as a major in the Urban System Planning Course under the Graduate School of Science and Engineering. Students are provided with basic subjects on sustainability, specialized subjects in each specific areas, seminars, domestic and international fieldwork. Although English is used to present, it is not the dominant teaching language and homework or reports are sometimes allowed to write in Japanese. For the time being (2010) the program has involved 49 Master's second year students and 54 Master's freshmen.

The University of Tokyo Transdisciplinary Initiative for Global Sustainability (TIGS) is responsible for general sustainability activities. However, the university have its own inter-departmental academic program (Graduate Program in Sustainability Science - GPSS[2]) which offers masters and doctoral courses under the Graduate School of Frontier Sciences. Unlike GPSS of Ibaraki University, students can obtain a full time degree and it is as valid as those provided by other departments. Curricula are built from the Knowledge and Concept Oriented Courses and Experiential Learning and Skills Oriented Practical Courses. Students need to earn at least 30 credits chosen from the two categories and a master's thesis in sustainability. By 2010, there are a total of 37 students and 21 alumni. One notable feature of the program is it calls for students from all over the world and from various knowledge bases, which is really comparable to the eligibility criteria of IPoS[3].

Kyoto University Kyoto Sustainability Initiative (KSI) is the active organization for sustainability education in Kyoto University. It was

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[2] Please refer to this website for more information
http://www.sustainability.k.u-tokyo.ac.jp/

[3] see Chapter 4

established in 2006 in collaboration with seven other institutes but not until 2008 the program incorporated students from other majors other than in the School of Global Environmental Studies' Environmental Management. Students who have taken at least six courses provided by the KSI and a total of at least ten courses provided by the KSI and KSI collaborators are able to obtain a certificate stating that they have completed the KSI Sustainability Science Course (KSI, 2010). Courses are mostly akin to four fields of Recycling-based Society, Climate Change, Inter- & Intra-generational Balance and Environmental Risk Management. Students majoring in science courses are encouraged to take natural courses, and vice versa. As of 2009, there are two students completed the KSI Sustainability Science Course and obtained their certificates. Besides, Kyoto University hosted the *Institute of Sustainability Science* from 2006-2008.[1]

Osaka University The university inaugurated RISS (Research Institute for Sustainability Science) in the same year as KSI and then the *Associate Program in Sustainability Science* in 2008. RISS is part of IR3S in conducting sustainability science program since 2007 with the support from Schools of Engineering, Economics, Human Science, and Global Collaboration Center. As scheduled, about 12 courses are provided with the participation of 45 enrolled students. Students then could earn a Certificate in Sustainability Science issued by the President of Osaka University and Senior Director of RISS.

Students of IR3S who completed some certain courses will all receive the common transferable authentication called "Certificate of SSC Joint Educational Program". One of the mandatory courses for the five participating universities is the intensive two-credit "Frontier of Sustainability Science" taught through television conference system.

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[1] Professor Satoshi Konishi was the director of ISS http://iss.iae.kyoto-u.ac.jp/iss/eng/

Table 5.1: Sustainability Program in Five Universities of IR3S (by 2010)

University	Tokyo	Kyoto	Hokkaido	Osaka	Ibaraki
Who leads?	Collaboration of 05 departments	Kyoto Sustainability Initiative involving 07 research institutes	Hokkaido University Sustainability Governance Project (SGP) of Hokkaido University Inter-department Graduate study in Sustainability (HUIGS) (going to establish GPSS)	Osaka University Research Institute for Sustainability Science (RISS) with "Sustainability Science Academic Program"	"The Institute for Global Change Adaptation Science (ICAS)" (2006)
From year	2007	2006	2008	2007	2009
Course Characteristics	Knowledge and Concept Oriented Courses & Experiential Learning and Skills Oriented Practical Courses	Legislative policies, Economics, Ecosystem resources, Educational ethics	Sustainability Science I,II,III,IV	Foundational courses (two modules) and specific courses (two modules)	provided as a major only in the Urban System Planning Course, Graduate School of Science and Engineering; as a sub-major in every other graduate course
Authentication	Master of Sustainability Science and Doctor of Sustainability Science (from 2009)	Certificate "completing KSI sustainability Science Course"	Diploma at the end of the school year	Certificate in Sustainability Science	"Certificate of Sustainability Science Course/Program" in addition to a master's degree in the respective major field.
	and a "Certificate of Joint Educational Program of the Integrated Research System for Sustainability Science (IR3S)"				
Current students	37 current students & 21 alumni	NA (02 graduates)	around 30 students	34 students	49 M2 and 54 M1 students

To sum up, education for sustainable development is nowadays implemented widely among higher education in Japan but when it comes to a genuine science, SSC is considered as the vanguard with the representative of elite universities. Taking members of IR3S as the object of long-term education for sustainability, we believe that we found the corresponding entity for the objectives of the study. IR3S universities are expected to have sustainability classes for their students, all of whom are from various disciplines of the school. Furthermore, lectures are encouraged to be carried out in English in order to enable international students to join. However, it is important to note that, those universities are, in reality, quite dissimilar in language usage, international student proportion and the number of learners per year. As a matter of fact, Kyoto University denied to join the study since it failed to attracting a certain number of students. The case study now comprises four sustainability education programs in total, with the population of approximately 225 individuals.

5.2 Methods and Survey Questions

Procedures In order to carry out the final survey for students in four universities, the researcher went over several steps

1. Literature review

2. Questions construction

3. Expert consultation

4. Pilot test and revision (twice)

5. Final questionnaire forming

6. Deliver to students and get feedbacks after remind them once

7. (Give gifts/souvernirs for the fullest and earliest answers and thank-you cards for coordinators).

The collected data then are divided into two groups, depending on a certain level of diversity before going to the next step of comparison and analysis.

Questionnaire was designed to send online to, first and foremost, the coordinators of each program, enclosing a request to students for taking part in the study. In the case of The University of Tokyo, questionnaire were sent directly to students and alumni after asking for their willingness to join. Then with the support and recommendation from the coordinators, message was conveyed to all students who had/have taken the sustainability courses. All they needed to do was to fill in an online questionnaire and this would be uploaded to the website after a submit-click.

Instruments Please refer to the previous Chapter, part 4.2.2, since the author use the same instruments, which are Survey Monkey and SpreadSheet, as in IPoS case study.

Research questions Besides the demographics and affiliation questions, main content of the survey is encompassing these key contents, divided into five groups: (The purpose of every matter comes in **bold**)

Classification Nature of sustainability classes in terms of cultural and academic background;

Interaction frequency group work activities and affection;

Components of sustainability education knowledge on sustainability and its source;

Cross-checking difficulties/gaps with classmates;

Complement Study objectives and desires.
(See Appendix for the detailed questionnaire)

5.3   Key Results

The expected quantity of respondents is equal to the population, however, in practice the number is much less due to several limitations[1]. Return rate is about

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[1] (see Chapter 7, section 7.3)

30%, as much as 59 replies. Feedbacks from The University of Tokyo (current students by 2010 and alumni) outnumber with 35 responses, following are from Ibaraki University (13 responses), Hokkaido University (7 responses) and Osaka University (4 responses). Among these answers, 55 over 59 are valid, otherwise it falls to one of the circumstances that

- did not complete the questionnaire, especially the questions marked with * (a required field); or

- answered the questionnaire, especially the questions marked with * (a required field), in a wrong way, for example the total of four percentage-fields must be added up to 100% but respondents put 100% for each blank.

Collected data for each group of questions are sequential as its target:

Demographics Participants come from 18 countries with about 56% (over 59 students) of them from Japan. Female is of the same number as the Japanese nationalities, slightly exceed male. Out of 52 accepted replies, 29 are from students who get influenced by other cities/towns rather than original hometown, 50% of those have overseas experiences. Around 80% of the answerers are of their young age (21-30 years old). The number of credits needed is varied by university (i.e. The university of Tokyo requires at least 30 credits for a degree while Hokkaido University, for example, asks learners to take only 10 credits for sustainability education) but on average, every student in the research took at least 17.7 units for this content. There is a huge variance among the background knowledge of participants: from development studies, environmental engineering, biology, horticulture, urban design, to dietetics, public health or music. Except 10 are Bachelor's, Doctoral and Research student, the study object are dominated by Master's candidates.

Classification Students are let to describe the nature of other participants in his/her sustainability classes in terms of cultural background, whether it is

"Homogeneous[1] - HG, Domestic diversity[2] - DD or International diversity[3] - ID" and in terms of academic major, whether it consists of "A very broad variety of background knowledge, Limited number of background knowledge or Roughly same background knowledge" which are hereafter called as Broad, Limited and Same for short. Over 78% of students think that they are in ID environment and the same number of students (44 persons) goes for 'Broad' choice. Only six answers state that homogeneous is the nature of their courses and three for 'Same'. It should be noted that, not all students who choose ID, choose Broad.

Groups are formed as such: all students of 'ID' and 'Broad' at the same time make up the first group (abbreviated as IDB). Coincidentally, this group members 'use mostly English in teaching and learning'. The answers that do not meet all of those above conditions are grouped to the second, namely Non-IDB. As a result, we have got 37 and 18 individuals for respectively the first and second group.

Interaction frequency Asking about the frequency of student interaction aims at seeing if they are really into their community or not and how significant their judge on diversity could be. Additionally, this frequency may tell us some hint of taking advantages of diversity, which will be later discussed in the next chapter. The answer for the question about the times for group working ranges from 0 (never), 1 (hardly ever) to 6 (always). Both groups have a fairly high evaluation (above 2, means 'often') for each item. The IDB group owns the extraordinarily constant timetable for group work in lectures and other interacting activities (an average of 4.27 and 4.43 over 6) whereas those of Non-IDB are only 3.28 and 3.17. Nonetheless, IDB members have the tendency of extra group-working at 40% more than their counterparts, whose frequency is only 'seldom' (2.17). The answer 'Never' appears seven times, but six of them belong to Non-IDB group.

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[1] Most classmates are from the same region of Japan

[2] Most classmates are from different parts of Japan

[3] Most classmates are from countries around the world

Table 5.2: Sustainability-related Knowledge per Student

Group	Sustainability Education Components					
	General knowledge on sustainability	Systems thinking and Consensus building	Critical thinking and reflection	The process that envisions a better future	Field trip and joint analysis participation	Creating partnership of sustainability
IDB	0.81	0.68	0.65	0.46	0.41	0.32
Non-IDB	0.56	0.44	0.22	0.39	0.17	0.28

For the question "How do behaviors and knowledge of group-mates affect the general outcomes of group work?", students can select among six choices of Always reduce, Sometimes reduce, Does not change, Sometimes improve, and Always improve the outcomes, coded as (-2, -1, 0, 1, 2). In such a way, when a reader looks at the positive value, he or she can tell the effect on learning outcomes is beneficial and vice versa with negative number. Although no group point out the overall negative assessment, individual negatives show up five times, only in Non-IDB, causing the average of this group is just as half as the other (0.67 & 0.78 versus 1.32 & 1.54).

Components of sustainability education Six components of sustainability were mentioned in this question: (i) General knowledge on sustainability, (ii) Systems thinking and Consensus building; (iii) Critical thinking and reflection; (iv) The process that envisions a better future; (v) Field trip and joint analysis participation; and (vi) Creating partnership of sustainability. Answerers click on one or many of the blank fields to show if he or she is equipped with that knowledge/skill or not. A number in table 5.2 is counted by adding up the choices for one component and after that divided by the sum of group member. In another words, one value, for example 0.81 in the upper first column, indicates that 81% members of the group is equipped with general knowledge on sustainability; or 0.17 tells us only 1.7 person over every ten students of Non-IDB has experience in field trip and joint analysis participation.
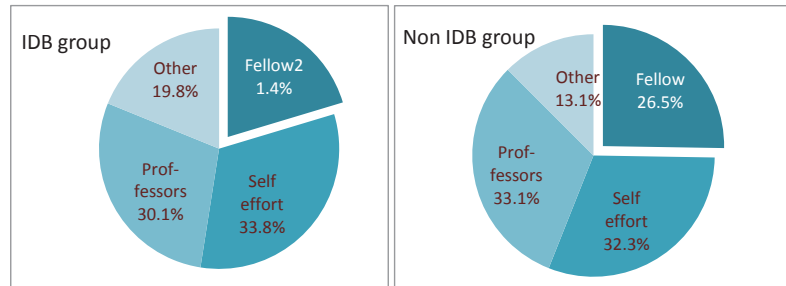
Figure 5.1: Sources of Sustainability Knowledge

Concerning which sources their sustainability knowledge are (whether from fellows & friends, self effort, professors with their lectures or from other bases), the answers must be available in percentage and four sources should make a total of 100%. However, specifically in this question, there are six misunderstood performances, equally split into two groups, and two in Non-IDB were left blank. Within 47 valid remainders, results are illustrated by figure 5.1.

Cross-checking In order to see heterogeneous study environment from various viewpoints, the researcher investigates the difficulties that students have with classmates in sustainability courses. As choices are from 0 (do not pose any difficulties at all) to 3 (have many troubles), the results reflect the most popular answer of IDB is 2 (some difficulties) while that of Non-IDB is 1 (very minimal difficulties) by using mode value. But when it comes to an average, IDB group members generally have less problems (1.46) than their peers in the other group. Figure 5.2 will guide you with detail information about learners' troubles in interactions with other class participants. Respondents as a whole have more troubles with their classmates' academic background, understanding level and communication. Even when the population of Non-IDB group is as half as of IDB, the volume of their difficulties via each aspect is less than one third of the diverse group. This is a dichotomous question so that explanations are also revealed. IDB members think that the different way of thinking-explaining-presenting, varied points of view, interests, conceptual mindsets, language & accent,
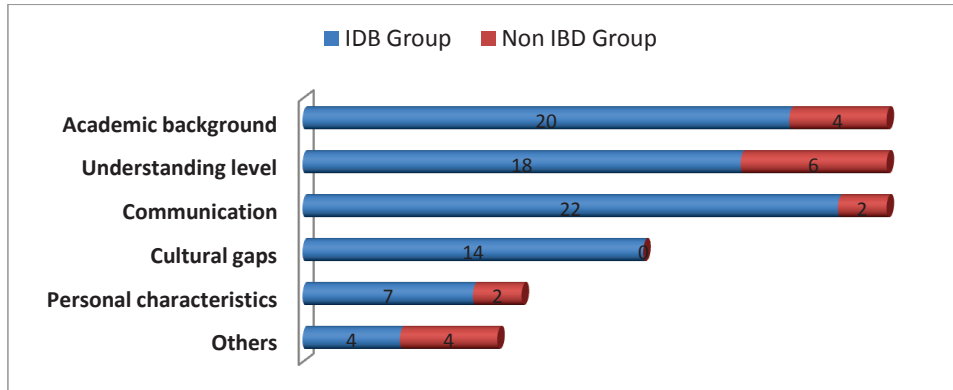
Figure 5.2: Count of Difficulties by Aspect

Table 5.3: Which obstacle should be definitely removed to get best learning outcomes?

Rank	IDB	Non-IDB
1	Communication	Understanding level
2	Understanding level	Communication
3	Academic background	Others
4	Cultural gaps	Academic background
5	Personal characteristics	Cultural gaps
6	Others	Personal characteristics

mutual respects, etc cause inconvenience in school and daily lives. This is somehow stated by Non-IDBers as well; both groups meet at several points like problems about the common sense, English language, or being left behind in class. Some insist that culture and personal characteristics do not impose strong disturbance on learners, but refrain from full explanations. As a complement for this set of questions, the survey seeks for which of the above obstacles should be definitely removed in order to produce best learning outcomes. Results are shown in table 5.3, where the first row shows the most unwanted problems.

Complement This part reveals three perspectives: (i) purpose and objective in studying Sustainability; (ii) the aspiration to be in a class with diversity of
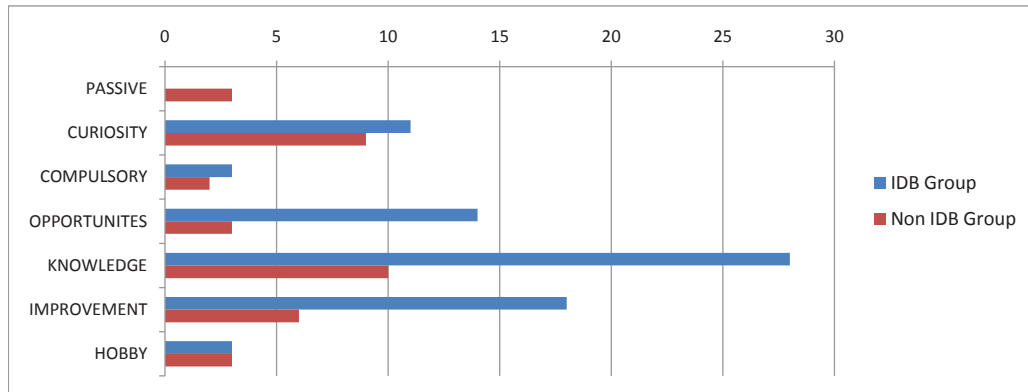
Figure 5.3: Purpose and Objective in Studying Sustainability

students if they have an oppoturnity to choose again; and (iii) the desire of any change in sustainability courses.

Figure 5.3 tells us about the tendency of students in selecting their study program, details of which are:

- PASSIVE- I was told and persuaded to join the courses of sustainability

- CURIOSITY- I just try the course because I feel curiosity

- COMPULSORY- Sustainability is part of the compulsory courses in my university. In addition, it sounds good

- OPPORTUNITIES- Studying sustainability may open up good job opportunities

- KNOWLEDGE- I want to broaden the understanding of issues around us. This field is new and might be challenging

- IMPROVEMENT- My background knowledge is relevant to sustainability and I want to make some improvement on it

- HOBBY- I specifically like this field and I like to do research on it.

When asking if they would like to choose to be in a class with diversity of students if they could study the course again, that only one say NO (in IDB) makes the positive answers entirely control the choice. In the end, quite a lot suggestions about improvement for the sustainability courses turn out such as[1]

Regarding IDB members

- "Maybe it needs more cooperation with other Sustainability courses not only within Japan, more practical activities..."

- "Need more lectures in human science (e.g sociology, philosophy, ethics, folklore)"

- "more opportunities to interact with related stakeholders in case studies classes"

- "In the beginning of the course, the faculty staff should present us 'this is the concept of sustainability we believe' so that we can integrate that aspect into our own research"

- "I would prefer more diversity of professors"

Regarding Non-IDB members

- "Political aspect is also important knowledge for applying sustainability program"

- "I want more Japanese students to take these classes. More effect advertisement is needed I think"

- "Case studies in other countries should be presented. The concept and applications of sustainability in Japan or Asia is almost different than in other countries" or

- "I would like to do more discussion in the course".

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[1] Simple obvious spelling mistakes were corrected. The grammars reflect original typing.

Chapter 6

Discussion

6.1 Implications from the Case Study One

6.1.1 From Observation and Interview

Shannon Index (or Shannon-Wiener Index) is popular to measure diversity in categorical data. However, educators do not use this term of estimating the species richness which reflects an ecological group rather than a human being community. As far as this research could reach, there is no well-developed theory or index to describe student heterogeneity in class, but the topic was touched on more than once in previous studies. Terenzini et al. (2001), when studying about racial and ethnic diversity in the classroom and how it promotes student learning, mentions the "diversity index", created by dividing the number of students who report their racial/ethnic identity to be non-white by the total number of students in the class. Employing this simplified way of defining diversity, our research population is obviously diverse, shown in the differences of nationality as well as culture (of every five students, there are approximately three types of citizenship), academic fields (social, natural and trans-disciplinary bases), and study degree (PhD, Master's & Bachelor's). There is no doubt that this group could be definitely the typical module for any research on diversity of students.

Observations help us to explore the activeness of the student's in-class discussions, whether any role of diversity may exist in fostering the class dynamics. We know intuitively that dynamics are central to understanding

complex, interacting systems (Scoones et al., 2007), which is the key of sustainability education. Classroom dynamics are shaped by three strong forces: classroom composition, enrollment turbulence, and funding pressure (Beder and Medina, 2001). Examining the class dynamics, Beder and Medina (2001) propose that discussions in which learners interact with other learners can develop such important group-dynamics skills as knowing when to assert and when to defer, or when to speak and when to listen. It is generally assumed that active engagement of students during discussion with peers, some of whom know the correct answer, leads to increased conceptual understanding, resulting in improved performance after peer instruction (Smith et al., 2009). Therefore, the role of student who starts the discussion is very significant. As stated in the result, reasons for this case's dynamics are students being (i) directly asked by the lecturer, (ii) stimulated by questions, and/or (iii) self-motivated. Teachers and their teaching methods determine the first aspect (i). The (ii) depends more on the students, although how instructor make questions is prerequisite. Data tell that Western students (Americans, Europeans and Australians are included) have critical role in class activeness. It is primarily because the educational system of the two regions form distinctive peoples. Packevicz (2010) conclude from his teaching experiences Asia as shown in table 6.1.

Not only Asian students are motivated by their fellows, those come from Western countries are also motivated (more exactly, 'demotivated' should be used) by hundred-percent Orient-cultured students.

> *"Yes, of course I have worked with some Asian friends in my university. Working with them in my project, I felt totally fine but here I encounter something totally different. Now I realize how the real Asian are. Maybe whom I met were already internationalized."*
> said a 26 year-old female from Europe.

Interview with Americans also reflects that some are not satisfied with fellow students in terms of language and academic level. Despite strong efforts of organizers in recruiting sound candidates for the program, there are still certain gaps in English-based communication among students. Placing students of diverse backgrounds in a classroom is a necessary but insufficient condition

Table 6.1: Western versus Eastern Educational Assumptions

	Western Assumptions	Eastern Assumptions
Manner	Individualism	Collectivism (group is more important)
Learning as..	Inquiry	Transaction
Mindset	No blank slates, bring experiences to discussion	Students are banks, waiting for deposits
Importance	Individual Interest as guiding priciple	What is important for the society
Motivator	Teacher	Student
Moral education	Individual identity, Self reliance, Self expression, Self motivation, Individual initiative, and Personal achievement	Group Identity, Reliance on those above you, Avoiding self expression, Self motivation & Taking initiative, and Personal achievement should not be praised

Source: Packevicz (2010)

for learning (Hurtado, 2001), hence individualism-oriented learners sometimes undergo disappointment partly due to over expectation before the study trip. Such concerns are well-founded, as research has documented that individuals may become less productive in group contexts than if they complete their work independently (Meyers, 1997). Nevertheless, it is defended by the organizers that the disturbance created by students with less English skills may have positive influence in the sense that it nutures motivation to talk and share from both sides. This two-faceted interaction, on the other hand, promotes mutual understanding, also accelerates the 'learning to live together', which is indispensable pillar of sustainability education (see Delors, 1996).

6.1.2   From Questionnaire

New knowledge on Sustainability Most of their knowledge is seemingly attributed to the instructors of the program with their lectures and

materials, shown in the overall 40 percent of evaluation. At the same time, the knowledge proportion gained from class peers is very comparable: 36%.

> *"Lectures were most important for me, as some fields were completely new. Second most important were the other group members as they were from quite different fields and very helpful"* recalled a PhD candidate from Sweden.
> *"Discussions with fellows and friends hardly ever focus on sustainability, but are circulating around the topic pretty often (recently). Lectures are best for understanding the terminologies"* - shared a male student of The University of Tokyo.

That some students figure out self-study does not contribute much is mainly due to the cramped schedule from morning till evening. The fairly balancing ratio is not well-matched with Ladd et al. (2009), who synthesizes and concludes that among many factors in schools, it is conceivable that peers matter most, as compared to teachers or parents, exert greater influence on students engagement in school. The common thing between IPoS participants and these mentioned school-aged youth are they spend the vast majority of their days immersing in an educational context in which they are surrounded by and interacting with class mates. However, if there is a zero assessment for two other choices 'professor' and 'self-effort', there is at least 5% for the second choice. All students meet at one point that their friends' knowledge more or less have impact on the newly gained knowledge on sustainability.

Benefit for Studies Terenzini et al. (2001) judges that diverse student body is more educationally effective than a more homogeneous one. In other words, diverse student bodies and classrooms, the argument goes, are more educationally effective than are less- or non-diverse ones. As a truly heterogeneous group, IPoS manifests the argument's righteousness: all the components of sustainability education (see Tilbury and Cooke, 2005) are valued significantly in the upper half of the scale whereas the negative effect does not even show up. The higher the evaluation is, the more benefit the

study climate brings to individual. Exceptionally, the assessment appears most often in this data set is 'very much benefit on the study' (equivalent numerical value is maximum 5). No Zero answer ('it even makes my studies worse') is detected, indicating that all influences of diversity are either null or positive. 'Systems thinking' receives lower grade (3.81/5) than other components implying that the competency is probable to be provided by lecturers rather than by class members. Concurrently, 'participation skill' is valued the highest point of 4.33. Genuine participation in the learning experience is essential to building peoples abilities and empowering learners to take action for change towards sustainability (Tilbury and Cooke, 2005, pg. 39). One may not be a specialist or expert in some field, but if gain proper participation skill, he or she could actively take part in any process of decision making, that ensure the multi-disciplinary principle. This process, thereupon, equips learners with further knowledge, with leadership skills for future actions, and promotes the other four components as well.

Difficulties/gaps & Productivity reduction Difficulties evolve mostly in group work, provided that 25 over 27 replies insist on this; while that in lectures and after-class activities are 19 and 10 respectively.

> *"The work process has been significantly much slower than if it had been an disciplinary and mono-cultural group who performed the work"* an Swedish Master student stated.

As how lectures go depend considerably on the instructors, and outdoor activities (such as visits or field exercises) are supposed to free students from closed indoor environment, group working time is when they have to seriously face and deal with dissimilarity of fellows.

When studying abroad to Japan, generally speaking, Asian students were more critical of living conditions and attitude than their Western counterparts, who perceived more dissatisfaction with the quality of education (Tanaka et al., 1994). That is not wrong when we look at this differences in table 6.2, comparing opinions from random individuals in this

Table 6.2: Different Difficulties of Asian and Western Students

Asian	Western
- strong leader	- Complicated concepts or tools.
- sometimes not so focussed...but nice to work in interdisciplinary teams	- not enough time or too much time allocated to certain projects/exercises
- English problems in communication and pessimistic mind of some guys	- Poor language skills
- ...	...

case. Getting to know about this psychology is exclusively important for the master of the class when handling with diversity.

On account of those problems, most of students (24/27) did not meet full expectation on their outcomes of the program. This productivity reduction is shown in percentage, where higher rate means more downgrading in realization of expectation. According to Levin's research in 1993, productivity is taken as the search for patterns of educational body that produce the best student outcomes (recognizing that what is "best" is not a self-evident matter) although in education, outcomes are multiple, jointly produced, and difficult to weigh against one another. Since a better understanding of productivity in education requires attention to what students think and do, we are now focusing more in the outcome of individual student. An average of 30% productivity reduction is very critical, but it does not say much about the trend of evaluation. About 90% reduction in ranking of some students hint that they expected too high about other participants before joining the program. In the same way, every choice of zero percent discloses that the study climate is matched with what was assumed before. Coincidentally, these three zero choices all belong to people from Asian-based institutions.

Intensity of diversity Despite all difficulties participants met during the program, especially those from classmates, the students are very generous in giving points to diversity. By choosing "normal and it is good for studying",

the majority indirectly refuse the statement that it is "too much that you may not be able to adapt yourself and get the best studying result" or either it is "quite much and it does not necessarily to form such a diverse group to study sustainability". Paradoxically, despite the fact that satisfaction and productivity often go hand-in-hand (Woollard, 2010), the person with 80% decrease in output selects the lightest criticism for this class environment, which tells this is not a big matter and he would like to be challenged in a more diversified group. This could probably be interpreted better when we looking at both short-term and long-term education; but for this time being, the feeling of elation of having new friends, new experiences and the satisfaction of curiosity (see Ogden, 1926, chap. 10) can partly explain the result.

> *"Actually, I do really like this diversity, and it let me know more. (especially to talk with others)"* recalled the student who set low grade for class performance.

6.2 Implications from the Case Study Two

6.2.1 Benefits From Students' Diversity

According to Chapter 5 about group classification, we have two comparative research objects: an international and multidisciplinary group (named as IDB) and a less- or non-diverse one, which is called Non-IDB. Both group members have been studying sustainability courses with an average of 17.7 units per person. Since obtaining roughly about eight courses on sustainability-related topics together, one respondent, thus, is believed to have sound judgement on the program as a whole and on fellow students.

Interaction frequency Group working is an essential segment in many fields, particularly in education. According to Michael A. Campion (1993), the

establishment of groups is consistent with a psychological approach, and is thus intended to increase satisfaction and related outcomes. Furthermore, he argues that membership heterogeneity in terms of abilities and experiences has been found to have a positive effect on performance (in the case of working under organizations). In education area, most instructors report that after peer discussion, the percentage of correct answers, as well as students confidence in their answers, almost always increases (Smith et al., 2009). We could refer that the group with more frequency in working with each other experiences more interactions inside its environment, and thereby exposes more to both plus and minus impact of the heterogeneity.

IDB group works more often than Non-IDB in all phases, in- and after- class. Group work in lectures depends on syllabus's design and instructor's methods while that of other time slots is attributed mostly to the students themselves. The frequency in extra group work[1] and other interacting activities[2] of the two groups make a fair distance. IDB students uniformly spare a certain amount of time for these sessions, when a number of Non-IDBers even never do extra grouping. There must be some impetus for a more diverse body to be more active than the other. As Michael A. Campion (1993) proved the effectiveness of work group to the final outcome, examining this case study also tells something similar. With an almost double improvement compared to Non-IDB, IDB affirms itself to be superior, especially when no negative evaluation is found during the entire working process (figure 6.1).

Components of sustainability education Results from table 5.2 (Chapter 5) show that none of the sustainability aspects of the less diverse group is assessed higher than the other group. Doubtlessly, a diverse student body provides students with important opportunities to build the skills necessary for bridging cultural differences and may cultivate their capacity for other important learning (Hurtado, 2001). In addition, the greatest variance of two groups goes to "critical thinking and reflection". As well, Hurtado (2001), who did study about a group

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[1] Extra group work is done as for the requirement of homework, projects or for further understanding among a group of student

[2] Other interacting activities: such as field work, academic or nonacademic clubs, parties, gossips...
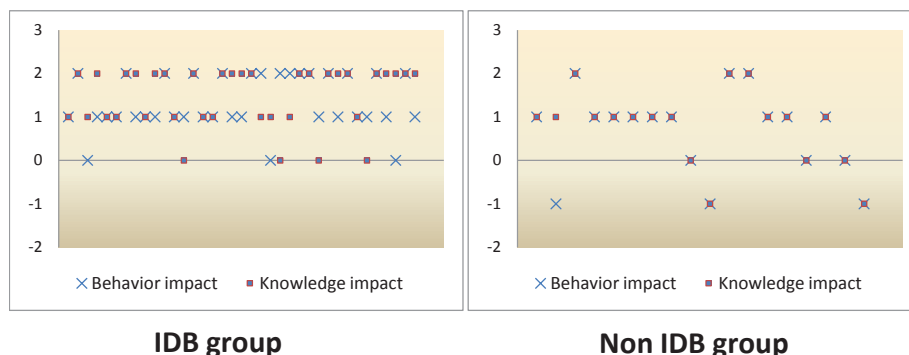
Figure 6.1: Impact of Group-mates onto Learning Outcomes

of different racial/ethnic background, deduces that those students [*members of the more diverse group*] appear to have more pronounced effects on self-reported growth in critical thinking and problem-solving skills. It is evident to say that a more heterogeneous class, in terms of cultural and academic background, as well has undeniable development for critical thinking competency. Critical thinking enables us to ensure that we have good reasons to believe or do that which people attempt to persuade us to do or to believe (Bowell and Kemp, 2002, pg. 46). In the context of this research, critical thinking is an essential part of learning for sustainability approaches as it challenges the way people interpret the world and how knowledge and opinions are shaped by personal experiences and social influences (Tilbury and Cooke, 2005). Field trip & joint analysis participation and general knowledge on sustainability both mark the second highest difference between two groups and regarding the quantity, respondents of Non-IDB who set forth the former choice is very few (only three responses). Using the same logic as in preceding section, participation skill is not less meaningful than critical thinking competency in sustainability education for higher educational system.

6.2.2 Hindrance From Students' Diversity

Extracted from figure 5.2, the descending number of difficulties can be ranked by group as in table 6.3. The first row reveals the most emerging obstacle of students in their study environment. It is not hard to understand why absolutely

Table 6.3: Difficulties in Sustainability Program

Rank	IDB	Non-IDB
1	Communication	Understanding level
2	Academic background	Academic background
3	Understanding level	Others
4	Cultural gaps	Communication
5	Personal characteristics	Personal characteristics
6	Others	Cultural gaps

no cultural gaps present in the more homogeneous group while many occur in the diverse group. 'Communication', which is meanwhile low rated in the second group, is the most problematic perspective among IDB members. Two reasons for this phenomenon should be discussed. Firstly, while IDB group use mostly English in teaching and learning; lectures, as well as projects, discussions or in some special cases, given to Non-IDB are allowed to resort to Japanese. It is quite visible that the portion of Japanese nationals in the latter group is larger, therefore they obviously share the same language and often have similar way of thinking. The second point takes a broader meaning of 'communication'. IDB group, unquestionably, is consisting of multiple nationals from all over the world. The Japanese students make up (representatively) only 20% of the population, so that it can be considered as 'a group of foreigners'. Since foreign students often suffer from not only academic stress, language proficiency or cultural gaps, but also from understanding communication with professors, the complexity of the senior-junior system in Japan, and they can not feel fit into the hierarchical structure of human relations (Murphy-Shigematsu, 2002), this situation often leaves the student with a bunch of daily worries.

The question then turns to be: Is the more diverse group subject to undergo more difficulties in general? Looking back at table 5.3, the annoyance degree of obstacles for each body is viewed from top to bottom. Understanding level is always considered as the major drawbacks for sustainability learners (approximately 1/3 of all choices) and communication skill as well, particularly in the group of more multiplicity ($\sim$32% of IDB choices). Cultural gaps and personal characteristic differences have almost nothing to do with the more uniform body

Non-IDB and henceforth they find it is not necessary to remove the obstacles. Noticeably, there is one field which allows respondents to choose nothing, meaning no difficulties would rather be discarded. While no one in Non-IDB selects this option, eight students of diversity choose it because "I don't think those affect our learning", "it [*difficulty*] is a part of learning process", or "we should learn how to handle them and improve ourselves".

6.2.3   Desire and Change

Choose to be in a diverse class Students were asked if they had a chance to study sustainability courses again, whether or not they would choose to be in a diverse class. The entire Non-IDB group all together agree that they do want to expose themselves to the class of diversity of student since

> *"I think environment with diversity of students is important for us to solve environmental issue"*
> *"I like to be in a class with diversity of students because I can know many diferent places culture"*

Among 37 replies from the more diverse group, only one said NO with the reason that "student diversity is not a matter to choose a class for me because I would like to learn technical skills rather than communication from now on". To this student, the experience of being in non-homogeneous class once is enough. Meanwhile, the rest 97% see diversity as opportunities and appreciate the more, the better. They value "diversity enriches discussions in the class", "Diversity of background (culture, experience, knowledge) stimulate thinking, also help us appreciate 'common elements' despite [against] diversity" and "It teaches you to be open minded and don't judge, specially when you come from a country very homogeneous (like mine)". This nearly-absolute result reports the strong desire of all sustainability students to involve in a class with various background knowledge and cultures.

Desired change Report on the favored changes shows students are more concerned about the content of sustainability program than the study environment, in both groups. The syllabus design is preferred to involve more

- cooperation with programs in the world;

- practical activities (simulation, workshops, games, skill training; field trips) to enable students to take action and do case studies from other countries;

- conceptual and historical practices;

- lectures on human science, political science, and social science methodology;

- interactions with related stakeholders;

- joint research for all sustainability students as a big group; and

- specified sustainability description for any background or major.

About program's structure: While an IDB student demands more credits in English, one from the other group wishes to have more Japanese mates in class. A student from an optional program addresses that he needs his peers in sustainability classes to be through a selection round, to be committed and continual. This does not happen in a degree program, where all students have to take an exam (and often interview) before entrance to the department.

Particularly, respondents also comment on teacher methods. "Professors and Advisors play a very large role in stimulating and consulting with students". "Lectures should be somehow planned and let students know at least what you'll learnt today". There should be more discussion, participation and debates in class and even diversity of professors (instead of males, engineers and Japanese instructors as at present) is demanded. Learners need to receive feedback from submitted reports for betterment and even more push [*pressure*] during the courses. "I hope the professors to think more carefully when they supervise students who lived overseas for a long time".

For improvement of the education, some suggest that the program would rather concentrate course work or research at one time, not simultaneously and sustainability course should also be extended to undergraduate level.

6.3 Inter-relation of the Two Cases

Doing case study One (IPoS, short-term education) and case study Two (SSC, long-term education) both aim at finding out the relationship between sustainability education and diversity of students in terms of cultural and disciplinary background. The two studies are seen equally significant. IPoS case helps us look into the dynamics of a diverse body while studying about SSC community is to understand more about the distinctness of heterogeneous against homogeneous class climate. Research questions to assist the overall objectives are very much alike in the two cases but due to natural differences of a few-day versus an official course (in motivation in joining the program, course structure, students' capacity or the willingness to involve sustainability education, for example), following comparisons arise:

Motivation of learning What is the purpose of students for taking part in the sustainability education program? Examing SSC students, (figure 5.3) about two thirds of the research object report the main target of taking the program is for KNOWLEDGE (*I want to broaden the understanding of issues around us. This field is new and might be challenging*). As one can choose multiple purposes, the reason for IMPROVEMENT (*My background knowledge is relevant to sustainability and I want to make some improvement on it*) and CURIOSITY (*I just try the course because I feel curiosity*) also account for more or less 40% singly. Long-term students do not generally study just for hobby for being pushed by others. It is, on the contrary, not the case in the short-term IPoS. Picking up from self-expression of students, the most popular expectation of participants is to meet and share ideas with different people around the world. Moreover, to enhance the social network, to exchange ideas and to know new friends are among their aspirations. Being clear about the learning goals enable SSC students to give out more well-balanced choice while opinions are really fluctuating among IPoS members. Since the expectation for a short-term is not academically immense, students tend to be generous to evaluate and be content with the final result. In addition, student motivation naturally has

to do with students' desire to participate in the learning process (Lumsden, 1994). IPoS students are supposedly more motivated than long-term peers.

Benefit from diversity Back to Terenzini et al. (2001) argument that diverse student body is more educationally effective than a more homogeneous one, we can see it is totally ascertained in both cases. Although students evaluate what they gained from their fellows is lower than from professors and the productivity reduction is high, they eventually got interested in it much. This is proven by the choices to be in the diversity class (IR3S) and in the final evaluation (IPoS). Peers with less experience of diversity are exceptionally desire to try it once. Participation skill is highlighted as the most sufficient outcome among IPoS members and critical thinking ranks second. This is interchanged for the students with longer experience of sustainability education. Critical thinking competency is where we can distinguish sustainability students with others. Systems thinking is probably accumulated better in a longer time, since short-term students do not weigh this ability very high.

General difficulties In practice, it is said that (Tanaka et al., 1994) those who had not been in Japan for so long should indicate better adjustment. The most prominent obstacles are about the interacting with other participants (language, communication, way of thinking...) and some stem from the connection with professors. Nevertheless, since [*international*] students who stay in Japan longer have to care of, as speculated by Tanaka et al. (1994), penetrating deeper into social relationships with Japanese, they encounter communication problems, perception gaps, value differences, etc and the nature of such difficulties is that time cannot solve. Worsestill, those more competent in the Japanese language should be less adjusted (Tanaka et al., 1994). The difficulties do not directly impose on their sustainability education, but in this particular case in Japan, foreign students of long-term have more pressure, for example these students often suffer from academic isolation and in their social relations, if they do not master Japanese sufficiently to communicate beyond the level of daily conversation (Murphy-Shigematsu, 2002).

That students in degree programs seem not to be as well adjusted as those in non-degree programs (Tanaka et al., 1994) appears to be true when comparing the two cases. Shared opinion is how all students look at the problems: with regard to difficulties in interacting with mates in sustainability class, the majority considers it as an acceptable, even inevitable matter of the education.

Chapter 7

Conclusions and Future Work

7.1 Findings and Recommendations

Theoretical foundations for sustainability education and the diversity of students: The goal of Education is basically featured by four pillars: learning to know, learning to do, learning to be and learning to live together (Delors, 1996). In order to meet the emerging needs of a sustainable society, education is embedded with the fifth pillar with various labels like Learning to transform yourself and society (Black, 1999), Learning to change (learn how to learn, critical thinking ability, interpersonal skills, and creativity) (UIE, 2003), Learning to live a legacy (Gokhool, 2005), Learning to live sustainably (Hargreaves and Fink, 2006), Learning to respect the planet (Jarvis, 2008), or Learning to transform society and change the world (DESD). Regarding this new form of education, many terminologies to describe sustainability education exist, such as Education for Sustainable Development, Education for Sustainability, or Learning for Sustainable Future. All of them indicate a common pedagogical approach which seeks to empower the learner to explore and engage sustainability (see UOG[1]) and attempt to equip students with new skills rather than merely 'know, do, be, live together'.

Diversity in education is not an unexplored topic, especially with respect to racial and ethnic heterogeneity. Both positive (Ely, 2004; Gurin et al.,

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[1] University of Gloucestershire UK Homepage
http://www.glos.ac.uk/about/sustainability/education/Pages/default.aspx

2002; Hurtado, 2001; Terenzini et al., 2001) and negative (Beder and Medina, 2001; Thatcher, 1999; Wood, 2003) impacts have been found on the productivity and learning outcomes when various type of learners study together. If say transdisciplinarity is essential for sustainability education (Lawrence and Despres, 2004; Nicolescu, 2005; Padurean and Cheveresan, 2010), diversity in disciplines and cultures must be contributing more or less to the education. Moreover, since the study climate has obvious influences on 'learning to live together', how to create a sound class environment is practically important.

Japanese universities with sustainability courses and student composition: In Japan, universities are generally not the foremost and popular choice of high school youths after graduation. National public universities are always believed to be tougher, more intense but more prestigious than others. However, college time is prevalently considered as 'moratorium' (Sugimoto, 1997, 2002, 2010), and students are often left backwards in the development of creative thinking, original problem formulation and critical analysis in the area of social issues and political debates. The higher educational system has been quite homogeneous in language usage (Umakoshi, 1997) as well. Sustainability contents have been incorporated into the syllabus since the last decade, and higher institutions (five top universities) helped promote the trend by developing the Sustainability Science Consortium. These universities create educational program for graduates and recruit students all over the world, using English as the main pedagogical language. As after an average of three years implementing, SSC has attracted approximately 225 students from at least 18 nations in the world. Participants in the survey report a balance ratio of male-female, Japanese-non Japanese students and a wide range of discipline foundation.

Impact of diversity Learners have multi-faceted reflection on the environment where fellows' differences of background knowledge and cultural bases exist.

Positive Class dynamics which promote understanding the sustainability knowledge, is cultivated by having intense discussion during and after

class activities. Differences of students, as observed, bring about lively debates due to mutual motivation. Integrating both Asian and Western education style in an environment is recommended, in order to take the most advantage of students' knowledge and experience. New knowledge of sustainability gained is attributed the most to professors with their instructions and materials; but the proportion from fellow students is very comparable. A diverse student body is proven to be more educationally effective than a more homogeneous one. Behavior and knowledge of mates impose no negative impact on learning outcomes of the mixed group (even they seem to spend more interaction time with one another) while some efficacy reduction noticeable in the less diverse body. Among the components of sustainability education, 'Participation' and 'Critical thinking' are improved the most, thanks to the interaction with heterogeneous classmates. Therefore, a sustainability class should involve differences of students to at least 50% to promote these two competencies, and to develop the willingness to accept diversity of native students. Eventually, almost all students (more than 90%) appreciated the chance to learn in diversity and showed interest in joining such a class again despite the argument of Woollard (2010) that satisfaction and productivity often go hand-in-hand. Concerning the respect for dissimilarities, the members of more diverse class expressed themselves as understanding and sharing by not minding any obstacle. They really learned how to deal with the diversity and even enjoyed it.

Negative Relatively homogenous classes seem to promote sharing and community (Beder and Medina, 2001). As students originated from different educational systems, a number of mindset (way of thinking) contrasts and communication barriers are reported after the two cases. Objection to other participants' behaviors are also mentioned, although not in so many cases. Real productivity is reduced, especially in a short time of studying together, while some expectations of learning outcomes are high.

Comparison between short-term and long-term education The first case study looks at the dynamics of a diverse body while studying about SSC community is to understand about the distinctness of heterogeneous against homogeneous class climate. Long-term students' motivation is basically to focus on academic sides and successfully acquiring a certificate/degree while short-term peers' aims are beyond that. IPoS students are supposedly to be a little more motivated. Short-term program benefit students more in terms of Participation skill whereas the other program accelerate critical thinking. Systems thinking is probably accumulated better in longer time of study. Foreign students (in Japan) of long-term have more pressure and difficulties, and students in degree programs seem not to be as well adjusted as those in non-degree programs (Tanaka et al., 1994). Roughly speaking, it is academically better for international students specifically in Japan to enjoy a diverse class rather than struggling in a homogeneous climate with almost all Japanese students.

Other recommendations Recommendation to encourage students' participation: Many students reduce their efforts in group activities because their contributions to the collective effort remain anonymous and unevaluated. Students may feel that their accountability is lessened because the instructor will not identify or assess their individual work (Meyers, 1997). Therefore, it is better to rotate group members constantly. Regular evaluation from and for each student will foster member participation; or else, leadership role should be rotated among members, as suggested by Sharan and Sharan (1976).

Classroom climate is important. If students experience the classroom as a caring, supportive place where there is a sense of belonging and everyone is valued and respected, they will tend to participate more fully in the process of learning (Lumsden, 1994). Classroom climate is contributed by teachers, school leaders and the members of it as well; therefore it is important to foster the three elements equally.

7.2   Significance of the Research

Diversity of students in education is not a new topic but most of the literature to date were talking about diversity in age, gender, ethnic, or race. What distinguishes my research from previous attempts is that the diversity of students in cultural and academic background has been rarely touched so far. Additionally, the topic is about sustainability education, an absolutely fresh subject since the beginning of the twenty first century. A research regularly deals with one case study in a specific location, but here the author had the chance to do two cases of short-term and long-term education. This opens broader vision towards the education in higher educational system in Japan. Particularly, the case on SSC could almost cover the student population who officially register in a sustainability science program, thanks to the grand collaboration of various capable coordinators in the five big institutions in Japan.

After this research, the researchers hope to raise extra suggestions to later projects on sustainability education; and also to encourage current programs to reform themselves to achieve the better learning outcomes for students. The study's results expectedly contribute to the ideas of decision makers, school leaders, and especially teachers in teaching with and taking advantage the diversity.

7.3   Limitations and Future Work

7.3.1   Limitations of the Research

The research meets some of the unavoidable limitations such as

Questionnaire structure Word usage in the questionnaire is somehow not immediately understandable for readers and requires broad thinking, for example "benefit your studies" or "behaviors and knowledge of group-mates" (Source: from feedback). The question about "sources of knowledge" requires total answers should add up to 100% but a number of replies failed to apply it. Question asking if students would like to choose

to study in a diverse class is a Yes-No question. A polar inquest often leads to short answer without rich description, that may pose bias.

Number of respondents (in the second case) is fairly moderate for a couple of reasons such as little motivation; weak connection with respondents; the third party (resorting to introduction from the coordinator); number of contacts that the coordinator has; English proficiency or time limits. However, the population in the first case is nearly perfect (27/28 feedbacks) as it surmounts those shortcomings.

Language is among the obstacles for Asian in general, including Japanese nationals.

> *"This answering in English was difficult for me. I thought I have a problem in myself"* A Non-IDB member.

Actually some of the answers (in open questions only) are allowed using Japanese language for those to express the most detailed thoughts as possible.

Individual bias *"It is always difficult for a individual to have a correct impression for the whole group. My answer is just a general impression based on vague memories"*
"Sustainability is a difficult topic because it is not clear what it is. I still have some difficulties explaining it"

Author's drawback Personally speaking, Japanese language ability prevents me from using many sources of references while they are really essential to understand the context and psychology of students and educators in Japan. Besides, I did not understand thoroughly a few answers from the non-English speakers and what they really want to express. Did not go to the real field of every other three universities is among the disadvantages. The number of survey participants is not significant enough to do a statistical analysis (i.e. regression), so that I have little things to make it a more quantitative-related research.

7.3.2 Future Work

After doing this research, we reaffirm that diversity of students is very important in sustainability education but one single factor can not make up the complete success of the education.

> *Sometimes I feel even though professors do not understand what is sustainability. I like studying with students with different background, but I have not satisfied with the classes in sustainability course.* (shared a Japanese female)

Teachers sometimes do not best employ this characteristic and that might be a waste of resource. "What is the role of teachers or instructors in managing the class environment? Have they realized and taken the fullest advantage of the diversity? How to make use of diversity in class to the best extent possible? How to reduce the negative sides of the diversity? Or what is the limit of diversity of students to ensure the effectiveness of the learning outcomes? How to best apply the Systems Analysis for such a qualitative and long-lasting issue like education of Sustainability Science?" ... are among the questions that could become another research problems. Quoting a Master's student at The University of Tokyo, "*I think the problem of sustainable program is not the diversity of students, but the concept of sustainability itself and the structure of the program. I mean the importance of the academic, sustainable science itself*" might also suggest another sound future research topic.

7.4 Concluding Remarks

Diversity helps improve education overall, yet retains certain difficulties as well. Although students were quite uncomfortable with many parts of the program, they finally felt comfortable with the diversity. In order to take the better advantage of the diversity, communication among students (language skills) should be improved. It is good to involve western elements in sustainability education in Asian context and vice versa. To utilize the diversity of class (and to promote it), students need to be activated by teachers and the content of the

lectures or group work. To close the discussion, we would like to briefly reconfirm the four hypotheses stated in the Introduction chapter.

1. Diversity of students imposes a relatively strong influence on sustainability education, particularly regarding participation skills and critical thinking;

2. New knowledge on sustainability was expected to derive from friends or fellows the most, however, in fact professors with their lectures and materials play a primary role in giving information, as in conventional education.

3. Diversity, on the contrary, leads to various difficulties for learners; and

4. Long-term education with diversity of students is likely to accompany more impediments than short-term period.

The meaning of internationalization should have its basis in human rights and equal opportunity for all. It is time for shifting the basic idea of internationalization; what matters is not the number of international students studying in Japan but a basic philosophy which embraces students from various backgrounds, including international students and foreign nationals, as full participants in Japanese higher education. (Horie, 2002)

Appendix

1. **Questionnaire for Case Study One** "Case Study of Students Studying Sustainability"

2. **Questionnaire for Case Study Two** "Questionnaire for Students Studying Sustainability"

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