

Student Diversity Augments Studying Sustainability in Higher Education

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Abstract

Since 2000, and especially during the United Nations Decade of Education for Sustainable Development (DESD 2005–2014), many universities have begun offering educational programmes on sustainability. Over this span, the level and type of diversity among students have only increased. This begs the question: How does university student diversity affect sustainability education? What is productive and confounding about learners' cultural and academic heterogeneity? This research draws on a literature review, a survey of university students studying sustainability in Japan and an observational study. The results demonstrate that interaction between students from different cultures and disciplines clearly improves skills for sustainability education, especially critical thinking and problem solving. Moreover, the surveyed students expressed interest in and appreciation of opportunities to expose their sustainability research themes to audiences of various research fields.

Keywords: Diversity, discipline, student, sustainability, higher education

INTRODUCTION

Education for sustainable development (ESD), education for sustainability (Huckle & Sterling, 1996) and sustainable education (Sterling, 2001) are some of the many labels given to the emerging form of teaching and learning that involves

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solutions for growing global issues. Many other authors, including Combes (2005), Henry (2009) and Hopkinson and James (2010), have been endeavouring to interpret the term in different ways as well. The movement began under the nomenclature of *environmental education* in 1972. However, *education for sustainable development* is the most popular phrase today, although the term was not coined until 1992 in UN Agenda 21 (UN Documents, 1992, Chapter 36). ESD aims to (i) improve and reorient current education towards sustainable goals, (ii) develop public awareness and (iii) provide training for all sectors. ESD was significantly and widely executed during the United Nations Decade of Education for Sustainable Development (DESD 2005–2014) and once again has been confirmed as the platform to transform learners and the society they live in, in the World Conference on ESD in 2014. By developing knowledge, skills, attitudes, competencies and values required for addressing global citizenship and local contextual challenges of the present and the future such as poverty eradication, reduction of inequalities, environmental protection and economic growth, ESD is continuously expanding beyond its original Decade (Buckler & Creech, 2014; UNESCO, 2014).

Diversity is a very broad field; its background is murky (Wood, 2003) and its meaning is chameleon-like (Lumby & Coleman, 2007). It must always be put into context, otherwise readers cannot understand whether species diversity (biodiversity) or human diversity or which aspect (i.e., race, ethnic, gender, social status or other) is being discussed because of its wide-ranging values and impacts. Diversity of employees (regarding tenure, age, sex and race) can affect team productivity and work performance (Ely, 2004; Williams & O'Reilly, 1998). Diversity, which operationally refers to the special circumstances of women, gays and lesbians and people with disabilities (Piland, Hess & Piland, 2000) can, by empirical data, improve learning experiences through courses with multicultural and diverse content. Gurin and colleagues (Gurin et al., 2003) have carried out a series of studies about the impact of diversity in higher institutions. One study of 1,500 University of Michigan students showed significant change in cognitive growth (more active, better complex and critical thinking) after being exposed to ethnic and racial diversity in colleges. In this paper, we explore the importance of student diversity in a higher education context; the relationship of diversity with respect to majors and culture to education, particularly ESD.

The United Nations, especially UNESCO, has been working arduously on drafting documents related to diversity and education. The Universal Declaration on Cultural Diversity adopted by the 31st Session of the General Conference of UNESCO (2001), urged states in the world to reaffirm their conviction that intercultural dialogue is the best guarantee of peace and to reject outright the theory of the inevitable clash of cultures and civilizations and to preserve cultural diversity as a living, and thus renewable, treasure. In this pathway, education was chosen as a tool for promoting the positive value of cultural diversity by incorporating such diversity into curriculum design and teacher education. One year later, in connection with sustainable development goals (SDGs), the role of diversity was iterated as *'We are determined to ensure that our rich diversity, which is our collective strength, will be*

used for constructive partnership for change and for the achievement of the common goal of sustainable development' (Item 16, Johannesburg Declaration on Sustainable Development, United Nations, 2002). The Declaration was then reinforced by the UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005). At the time of writing, cultural diversity is in fact one of more than 10 sub-categories within ESD, on the official UNESCO web page.

The underlying linkage between ESD and diversity remains within the meaning of sustainability or sustainable development. If understood from different perspectives, its definition varies, but to mention a few:

1. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report, 1987).
2. Sustainability is an emergent property of a complex system (Allenby, 1999).
3. Sustainability is about change in political economy so that we could live sustainably with one another (Delors, 1996; Huckle & Sterling, 1996).

Sustainable development is characterized by encompassing a variety of objectives and disciplines (Kajikawa, 2008), dealing with complex issues of the nature–society system with multiple and interacting stresses. We cannot expect to yield a single solution but can employ a combination of different ways of knowing and learning for solving sustainability problems (Kates et al., 2000; Komiyama & Takeuchi, 2006). Academia and policy makers have higher expectations on sustainability education, or ESD, than on other educational fields, in terms of encouraging comprehensive changes. However, in fact, little has been done since Brundtland to make change happen, while most education even contributes daily to unsustainability (Sterling, 2001). Universities are still keen on advancing and deepening their own expertise, although this may have a limited contribution to students' holistic thinking. According to Kates (2011), as reflected in the disciplinary classification of related journals, sustainability science is and should be extraordinarily multidisciplinary in its nature; it should span the natural, social and technological sciences. The only way to understand sustainability is to put it into context; and in order to prevent chaos, the collaboration of various professionals is very important. Educational institutions, especially those in higher education, provide a conducive space where sustainability is contextualized. They must also be the place that enables learners to confront the diversity and complexity of sustainability issues from the foundation of their knowledge and competencies. Conventional class settings, originally designed for learning mono-disciplinary subjects, allow students to develop their fields deeply, but they hardly have a chance to be exposed to diverse discussions.

As cultural diversity should not be neglected, we propose discipline diversity as another critical factor for learning and teaching sustainability, especially in higher education. McKeown, Hopkins, Rizzi and Chrystalbridge (2006) had recognized that the challenges of sustainable development and ESD require contributions from numerous disciplines. The terminology includes *multidisciplinary*, *interdisciplinary* or *transdisciplinary*, which is perhaps the most recent and most used reference for

sustainability science (Kajikawa, 2008; Lawrence & Despres, 2004). Building such a scheme helps us to understand and helps faculty to educate students to solve complex interconnected sustainable problems. Taking climate change as a prominent example, we often see independent studies like physical mechanism of climate change, economics of climate change, climate change and social behaviours and ecological responses to climate change. Regardless of how deep those individual analyses are, if the *blind men*¹ do not work, communicate and compromise with each other, the *elephant*² of climate change could perhaps never be defined completely. According to the World Declaration on Higher Education for the Twenty-first Century (1998), higher education is believed to be a pioneer in changing and creating knowledge, where interdisciplinary and transdisciplinary approaches should be promoted and reinforced seriously.

Since research on this specific theme is limited, we believe that answers to certain questions will be meaningful and significant: (i) *What is the role of discipline and culture diversity of students in ESD?* (ii) *Is such diversity detrimental or is it beneficial to sustainability education?* and (iii) *How do learners perceive diversity in ESD (in practice)?*

METHODOLOGY

To understand the position of student diversity in ESD, we employed the case-study method, a common research tool used in studies of sustainability in higher education (Corcoran, Walker & Wals, 2004; Merriam, 1998). The steps of the study were as follows, but not limited to this numerical order:

1. A literature review was carefully conducted;
2. Experts were consulted (prior to field implementation) to increase survey credibility;
3. Questionnaire and interview of students taking a course about sustainability were the main procedures;
4. The quantitative and qualitative results were integrated for analysis so that the conclusions would be strengthened; and
5. Observational study was undertaken to enrich the reasoning of the research.

The key content of questions asked involved:

- What are the difficulties and advantages of having a diverse environment of peers in a class? How does this setting affect the learning outcomes of the sustainability elements of the curriculum overall, as well as for each component thereof?
- How does this type of learning differ from learning in a homogeneous class environment?

First of all, we contacted current students and alumni from universities providing sustainability education programmes (for more information of these programmes,

see Mino & Shimoda, 2011) through the main co-ordinator of each unit. These involve only Japanese public institutions (The University of Tokyo, Ibaraki University, Hokkaido University and Osaka University) though non-Japanese students were included in the study (in fact the number of foreign students is rather remarkable—see section Results and Discussions). The class settings for learning sustainability share the commonality that students are culturally very diverse and derived from various disciplines across departments. The SurveyMonkey® web-based tool for questionnaire development and delivery was used to conduct the survey. The questionnaire had 30 questions which were divided into five parts: (i) Personal information, (ii) Nature (attributes) of the sustainability class (language used, culture or discipline background), (iii) Interactions with fellow students and performance in the class, (iv) Difficulties and (v) Additional questions about purpose and desire in learning sustainability. Follow-up semi-structured interviews with students, who were selected based on their previous answers and willingness to cooperate, were later conducted for clarification of certain points. Lastly, an observational study was developed to monitor and compare the contextual differences between discussions in heterogeneous and homogeneous groups. Qualitative methods include attending and note-taking at seminar presentations and Q&A sessions, interviewing presenters and performing content analysis of the presentation abstracts and slides.

RESULTS

Case 1: Survey of Students

General information and group classification

Of the expected survey population of some 225 students, 59 replies were obtained (response rate was 26.2 per cent). Participants, although affiliated with the surveyed, co-operating Japanese institutions of higher education, represented 18 nationalities from around the world. Only about 56 per cent were native language users (Japanese). Notably, in contrast to most education in Japan, many parts of these sustainability educational programmes are conducted in English. Therefore, the students, whatever their cultural background, must manage this language of instruction at least above the basic level. Approximately 80 per cent of the respondents were 21–30 years old; the ratio of male and female students was 56 per cent and 43 per cent, respectively. Student backgrounds varied greatly—from biology, development studies, environmental engineering, horticulture, and urban design to dietetics, music and public health. As students self-determined their class status, while referring to this categorization (Table 1), they were divided into two groups: (i) IDB (ID and Broad), and (ii) Non-IDB, which includes the remaining types of matches.

According to the classification result, the IDB group is composed of students with a broad diversity of backgrounds representing various countries and outnumbered the non-IDB group by 33 per cent. The non-IDB group is composed of students who share similarities with their classmates or have experienced limited differences as they come from the same country, speak the same native language or work in closely connected disciplines.

Table 1 Choices of status for survey respondents regarding their fellow learners' backgrounds

Cultural Background	Academic Background
Internationally diverse (ID)	A very broad variety of background knowledge (Broad)
Domestically diverse (DD)	Limited number of background knowledge (Limited)
Homogeneous (HG)	Roughly same background knowledge (Same)

Source: From authors' questionnaire.

Benefits of studying sustainability

First, we asked the students from the four universities (The University of Tokyo, Ibaraki University, Hokkaido University and Osaka University) how frequently they interacted, (i.e., teamwork, contact, chatting) with one another in groups inside and outside the class, to determine whether their judgements about diversity afterwards were based on their actual experiences, and how significant those judgements were. Regarding the question *How often do you do group work or interactive activities with classmates in your sustainability education programme?*, answers ranged from 0 (Never), 1 (Hardly ever), 2 (Seldom), 3 (Occasionally), 4 (Often), 5 (Usually) to 6 (Always). Provided with three categories of activities—group work during lectures, extra group work and other interactive activities—the IDB members approximately scored 4.3/3.6/4.4 and the non-IDB members scored 3.3/2.2/3.2 for each activity, respectively. On an average, student respondents indicated 3.7, meaning quite often. The IDB group ranked this activity higher than the other less diverse group at 1.4 times. Of the seven informants who stated that he or she had never really interacted with class peers, six belong to the less diverse group (non-IDB).

Second, we then considered the benefits of studying sustainability. This is shown in the perception of students regarding how behaviour and knowledge of group-mates affect the general outcomes of group work. Our hypothesis is that the more diverse group would have better working results (see Figure 1).

Students were provided with five answer options about the learning outcomes: (i) *always reduce*, (ii) *sometimes reduce*, (iii) *does not change*, (iv) *sometimes improve* and (v) *always improve*, coded as (-2, -1, 0, 1, 2). Though diversity seems to pose no negative impact on the IDB group, some members of non-IDB group reflected that the learning environment did not advance their academic achievement at all. The average ranking for 'always improve the outcomes' is also higher in IDB, clearly shown by the density of blue and red dots in the row of code 2 (Figure 1). One reason that could explain it is: *'Sustainability is so difficult. Even after group work, I still cannot get the point'*, as a Japanese master's degree student of an identical class recalled.

Third, the advantages of interaction with fellow students from various research fields and cultures lie in the course's final results. Sustainability studies usually require learners to attain competency in six important components: (i) general knowledge regarding sustainability, (ii) systems thinking and consensus building, (iii) critical thinking and reflection, (iv) process that envisions a better future, (v) field trips

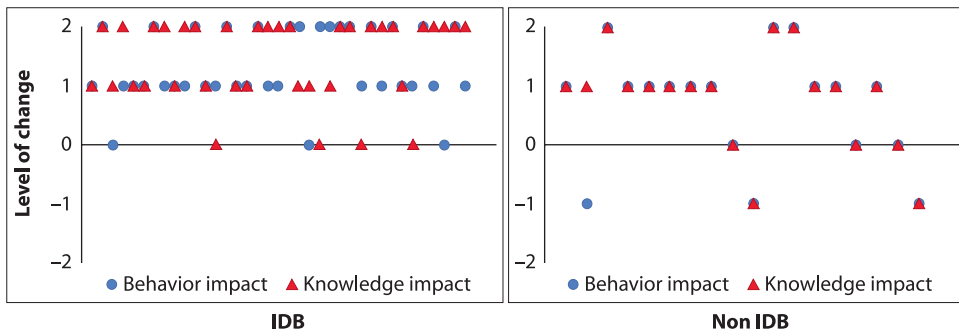


Figure 1 Group–mate behaviour and knowledge affecting general group work outcomes

Source: From authors’ own data.

Table 2 What do you think you gained/will gain from the programme?

Group (Per One Member)	Components of Education for Sustainable Development (n = 59)					
	General Knowledge Regarding Sustainability	Systems Thinking and Consensus Building	Critical Thinking and Reflection	Process that Envisions Better Future	Field Trips and Joint Analysis Participation	Creating Partnerships for 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

Source: From authors’ questionnaire.

Note: IDB: Internationally diverse and broad variety of background knowledge.

and joint analysis participation and (vi) creating partnerships for sustainability (adapted from Tilbury & Cooke, 2005). Table 2 shows the dissimilarity between the two groups.

The data demonstrates the rate of agreement with each answer choice. This means, for instance, 0.81 in the first column indicates that an average of 81 per cent of group members feel that they have gained general knowledge regarding sustainability. In the same vein, the ratio of the less diverse non-IDB group in acquiring ‘critical thinking and reflection’ skill is much less than (almost one-third) of the IDB group with greater diversity among learners. A diverse student body most certainly provides students with opportunities for building the skills and competencies essential for bridging cultural differences and may very well cultivate their capacity for other important learning (Hurtado, 2001).

Challenges diversity in class pose

A rich, diverse educational setting is not always the cure. The predominant advantages of diversity provide an illustration of its crucial position in the sustainability educational process. However, differing world views and experiences pose

numerous other challenges such as strong views from other members, difficulties in consensus building or language problems. Examples of opinions derived from students' own experiences in interacting with diverse peers are [sic]:

1. 'Because of the differences in academic background, I can't understand their presentations on their research very well';
2. 'All students were very busy with their task [of their departments]';
3. 'It will take a little more time to explain ourselves';
4. 'Some students did not know what I thought as common sense';
5. 'Communication style is also different due to his/her cultural background';
6. 'Sometimes don't respect each other'; or
7. 'The level of understanding English is different from Japanese students and foreign students'.

Figure 2 illustrates challenges and troubles that students have encountered as well as a comparison between the two groups by answer count.

A limited number of responses for this question (Figure 2) from the more homogeneous non-IDB group were not hard to fathom—not much difference in discipline and culture of the group exist, thus many of the gaps are not significant enough to mention. In other words, students do not feel the pressure of trying to change their minds, ideas and expectations or adjust their thinking to fit with the other members as much as in the more diverse IDB group. No cultural gaps in the non-IDB group were recorded. Language is one of the major hindrances to those in the IDB group where international students make up to 80 per cent of the group. Studying in a Japanese institution and using a foreign language of instruction could likely affect their understanding level as well. Interpreting from students' explanation, IDB group members think that the different ways of thinking—explaining—presenting, varied points of view or interests, conceptual mindsets, language and accent, mutual respect and other factors cause barriers in academia and even in daily lives.

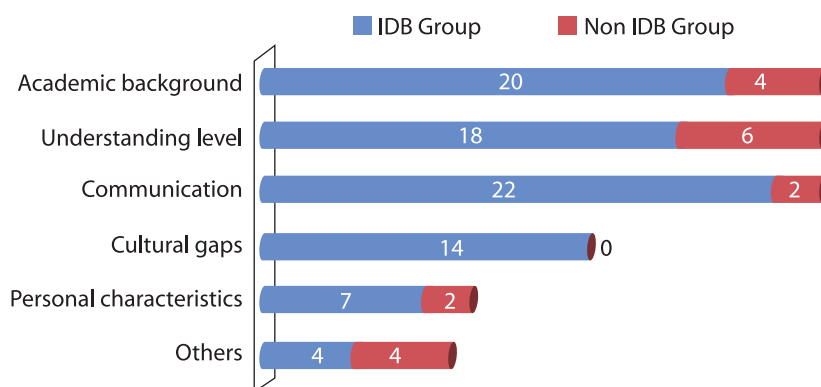


Figure 2 What are the gaps/difficulties with classmates in your sustainability classes/programme?

Source: From authors' own data.

Yet surprisingly, when raising an auxiliary question concerning which gap should definitely be removed to achieve the best learning outcomes, many IDB group members stated that such action was unnecessary. Those who experienced diversity together with its disadvantages shared their reasons as [sic]:

1. 'I think diversity of those are needed so that I could learn and improve myself';
2. 'These difficulties are unavoidable and dealing with them is part of learning process';
3. 'They give me some lessons that could be useful in building consensus amidst diversity';
4. 'Each obstacle may remain even after graduation. Try to learn how to overcome them is also a process of learning';
5. 'All of these are encountered in real life, so it is beneficial to learn how to handle them'; and
6. 'Think about sustainability' or 'it is worth to know and study sustainability'.

Case 2: Comparative Observation

This observational study was organized in such a way as to enable the authors to monitor discussion in two settings—students from the same discipline in a more technical seminar (commonly called lab-seminar), and students from different disciplines in a general seminar, about the same topic.

- Lab-seminar: one student made a presentation before similar background (discipline) students assigned to the same laboratory, who had been working closely with one another. Consequently, the members of the group were able to mutually understand the basic research objectives and routines since they came from a more homogeneous discipline. This seminar was attended by six to eight students and guided by one or two professors from the same discipline.
- General seminar: The same student then made virtually the same presentation to another group with more diverse backgrounds. The topic, which was interdisciplinary and related to sustainability, was new to this group of peers. This seminar was attended by 10 to 13 students and facilitated by two or three faculty members.

From this observation, we had expected to discover how the interacting environment affected learning outcomes, especially through the Q/A session and the self-evaluation of the presenter. The presenter's perception acts as an illustration of how the diversity of students can contribute to one's research either negatively or positively. We hypothesized that, although both forms of class setting were valuable, students would receive more inputs for sustainability skills when taking part in a multidisciplinary dynamic discussion.

This monitoring process was repeated twice with two students, namely, A and B.

Student A

Student A's topic was about waste management in India presented in a 23-slide PowerPoint. The student, a second-year PhD candidate, wanted to reveal the attitudes and actions of Indian households concerning reduce, reuse and recycle (3Rs). The student stated that the results of this research study in New Delhi's context had not been published before, and accordingly intended to also put forward relevant policy recommendations. In the presentation, student A described the research field's characteristics and current situation of waste management, with reference to waste generation, treatment, classification and pertinent legislation. By using a combination of quantitative and qualitative analysis methods, student A aimed to administer a questionnaire and conduct interviews with some 1,000–3,000 households as well as to hold some focus group discussions to solicit responses to research questions.

Observations: The main questions raised in the same-discipline laboratory group meeting were about the research objectives, previous literature, conceptual framework and overall logical structure. The general diverse-discipline meeting, in contrast, produced more specific questions such as (i) how waste was collected (formally or informally) in New Delhi, (ii) why student A focused only on households whereas many stakeholders in waste management co-existed, (iii) how waste management, sample size, questionnaire question types were determined, and other aspects. Also, some of student A's minor quoting errors (she used a citation source of Wikipedia, for instance) were pointed out.

A's response: Student A's overall reflection about the differences between the two seminar discussions is: '[in the general seminar] *there are more questions in the Q&A session*', and '*everyone seems to have understood what I am trying to do*', she said in delight. Her reasons for stating '*everybody understood*' include (i) almost all students, who were rather new to her study, asked questions whereas professors in the audience asked nothing; (ii) there was a greater variety of questions, with little or no deep discussion and (iii) '*maybe because the figures were clearer*' than the presentation done in the same-discipline laboratory meeting. Nevertheless, in her opinion, both dialogues were important to her research. On the one hand, the lab-seminar gave her in-depth understanding, and comments from professor supervisors as team leader, were also very critical. The different-discipline general seminar, on the other hand, enabled a greater variety of comments from fellow students which could in some way shape her future research direction and contribute real practices from many other fields.

Student B

Student B's topic was about employee education on corporate sustainability in connection with human capital practices. The second-year master's student designed a 40-slide presentation to convey her research on combining corporate strategies and employee leadership for sustainability. Using 21 cases from around the world as secondary data and 10 cases from Japan, United States and South Korea as primary data, student B intended to explore the methods that have been used for engaging employees in sustainability and to propose what is effective through a series of

interviews. The five engagement methods are labelled as (i) training, (ii) giving incentives, (iii) using social media, (iv) volunteerism and (v) green team.

Observations: In the lab-seminar, student B summarized those five types of employee engagement in sustainability as part of a tentative conclusion. In addition, student B also listed some barriers related to the implementation methods involving the complexity of implementation, shortage of adequate sustainability-related education/training, availability of funds or employee indifference and then highlighted some cases of American corporations (i.e., eBay, Green Impact, NEEF) with recommendations. The professor supervisor and many of the same-discipline group members were concerned about what led to the conclusions reached or how the logical analysis flowed, and how student B could validate the final recommendation. Then in the general seminar, due to time limitation, the closing remarks were not presented fully before the more diverse audience; yet comments like *'conclusions from the results were missing'* occurred. Other than that, typical comments included, *'Will they [the alleged sustainable measures] be truly sustainable? Have you checked whether they [the companies] did them or not?, How does [one of the five types] contribute to corporate sustainability?, or What was gained from the interviews should not be overestimated or underestimated.'*

B's response: In student B's judgement, the two experiences seemed to differ from one another basically because she slightly adjusted the presenting style after the first presentation in the same-discipline laboratory meeting. On the first occasion, student B received questions that, in her own opinion, were fairly challenging, critical and specific because her presentation showed weak results. Knowing that all attention could be drawn to that part of her presentation adversely affected the individual's confidence level. Student B therefore revised the way of presenting and drew the attention of audiences in the subsequent diverse-discipline seminar to the body rather than the conclusion part. The atmosphere of the discussion was *'kind'* and *'understandable'*, enabling student B to actively respond to questions and comments.

DISCUSSION AND CONCLUSION

'Education is enhanced by...interaction, which depends on the presence of significantly diverse student bodies'.

(Gurin et al., 2002)

According to the richly-built theoretical foundations developed by Gurin and fellow researchers since 2002, whose cases concerned racial and ethnic diversity (identity group) in education, the impact of diversity on student learning outcomes is especially important during the college years. Gurin also mentioned diversity's role in the '21st century education' in her latest research about intellectual diversity, which associates broad knowledge across many disciplines. Conversations about mixed disciplines have also been lively. Eagan, Cook and Joeres (2002) pointed out advantages of interdisciplinary training, and then highlighted the role of facilitating the ability to understand better, the complexity of real-world problems. Lowe and

Phillipson (2009), while criticizing the barriers to research collaboration across disciplines, by observing more recent research programmes, said that when a strategic commitment to collaborate is made, this can facilitate 'radical interdisciplinarity'. Our research evidence proves that student study and research in sustainability are highly encouraged by attending classes and interacting with peers from different academic and cultural backgrounds; and that discipline diversity, in addition to culture diversity, has an essential role in sustainability education.

We examined two studies by different approaches. The student groups in the first case study, which we classified according to their survey responses and called as IDB and non-IDB, perform as the main illustration for evaluating the impact of diversity. We tested how such student groups interact in their sustainability classes and observed that the IDB group works together more often than the non-IDB group in all phases: during lectures, extra group work and other activities. Simply speaking, IDB students perhaps need more time and effort to understand one another or to reach consensus; but beyond that, this interaction seems to be very beneficial to them. Frequent discussion creates more exposure to peers' intellectual knowledge and is likely to refine the group's final conclusion on complex problems. Besides, according to Smith et al. (2009), most instructors report that after peer discussion, the percentage of correct answers and student's confidence in their answers almost always increases.

Evaluating the effectiveness of practising ESD, it is widely recommended to observe how ESD's learning outcomes (Svanstrom, Lozano-Garca & Rowe, 2008) or key competencies (Wiek, Withycombe & Redman, 2011) are achieved by learners. The two classifications of students who participated in the survey demonstrate big differences in their acquired final outcomes. The more diverse group tend to have better learning outcomes and sustainability achievement than the more homogeneous one. Campion, Medsker and Higgs (1993) were concerned about exactly the same thing, that the establishment of groups was intended to increase satisfaction and related outcomes, but they were unable to see positive relationships of heterogeneity with effectiveness due to lack of heterogeneity in their sample. In the later part of the survey, we designed 'sustainability education' under certain components or competencies and asked how students perceive their attained sustainability knowledge because of interaction with their fellow students. As all of the sustainability aspects of the more diverse IDB group are assessed higher than the less diverse non-IDB group (Table 2), we strongly believe that a diverse student body provides students with crucial opportunities for building the skills necessary not only for bridging cultural differences and cultivating learning capacity (Hurtado, 2001), but also other important skills needed for a sustainable society. Hurtado also declared that those students (members of a more diverse group) appear to have more pronounced effects on self-reported growth in critical thinking and problem-solving skills, as evidenced in our results by the large gap between each item's values. Critical thinking enables us to ensure that we have good reasons for believing or for doing what people attempt to persuade us to do or to believe (Bowell & Kemp, 2002). Critical thinking is an essential part of learning for sustainability approaches because it challenges the ways people interpret the world and how personal experiences and social influences shape knowledge and opinions (Tilbury & Cooke, 2005). Sustainability education thus requires this

skill the most over the other six, even considered better than 'general knowledge on sustainability'.

At the same time, as pointed out by Thatcher (1999), diversity of a team or group does not always accelerate good outcomes, but in fact often causes dissatisfaction and to some degree produces negative outcomes. Of course, difficulties such as misunderstanding, communication or cultural gaps undoubtedly exist within diversity interaction. Part of the reasons are that English, which is not the mother tongue for all students, is the main language used in lectures and projects; and that foreign students in Japan particularly suffer not only from academic stress but also from other dissimilarities regarding their university life (Murphy-Shigematsu, 2002). Surprisingly, however, some students with experiences in heterogeneous interaction reflected that in the sustainability study (i) *These difficulties are unavoidable and I don't think those [gaps] affect our learning*, (ii) *That is part of learning process*, or (iii) *We should learn how to handle/overcome them and improve ourselves as it is beneficial in real life*.

Regarding the observational study (the second case study), we consider it as a supporting data for the previous survey. The benefit brought to student A's study from the general seminar is what is truly essential in sustainability education or ESD. This new emerging form of education is said to equip students not only with basic knowledge, but also with the competencies to negotiate, collaborate and anticipate future trends (Wiek et al., 2011). A bias may have occurred when either students A or B revised or adapted (the format of) presentations in the two seminars; however, these examples show that presenting in different situations, with diverse audience, especially when the topics are multidisciplinary, is very significant. Presenters A and B were especially appreciative of the opportunity to present their research to a diverse group of peers so that they could obtain fresh perspectives and then reflect on them with 'another' practical mind, which is also a goal of ESD (Tilbury & Cooke, 2005).

Even if a diverse group is unable to provide deep insight into a presenter's or speaker's research in sustainability, such a group can help develop a multi-oriented way of thinking under the approach of inter-discipline or even trans-discipline. Interaction with peers from other disciplines enables researching a problem from a broader scope, often leading to something unanticipated. Our ultimate goal is to position the rationale for engaging diversity in sustainability education, and to facilitate learners in collaborating across discipline and cultural differences. In this way, students can truly address issues like world view conflict, dispute or border separation naturally. We firmly believe that sharing such practical results has learnings for educators and administrators in managing diversity for their institutions' sustainability education.

Notes

1. Sustainability problem and its solution are often connected to an old Indian tale 'The blind men and the elephant', which is now made popular under numerous versions in different languages and cultures. Six blind men were feeling an elephant for the first time but each of them touched only one part of the elephant. This brought to different conclusions about the

animal as tree branch, a snake, a pillar and so on. Everyone was correct from their own point of view but no one could describe the true elephant.

2. See note 1.

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