The Effectiveness of the Methods and Approaches of ESD for 2030 Sustainable Development Goals; From Analysis of the Questionnaire Survey to the School Teachers

T Ichinose
Research Institution of Teacher Training and Development, Miyagi University of Education 149 Aobaku Aramaki Azaaoba, Sendai, Japan
E-mail: ichinose@staff.miyakyo-u.ac.jp

Abstract. ESD is a key element of quality education. Its cross-cutting competencies in cognitive, socio-emotional and behavioural dimensions of learning bear relevance to all areas of education. (UNESCO Executive Board 20 February 2019). This study, the result of four years of research in 279 primary and secondary schools in Japan, reveals that in integrated study periods, and with the engagement of local human resources, an increase of activities across different classrooms and grades are a clear result of enhanced ESD and students’ collaboration, cooperativeness, cooperative attitude, and ability to communicate are interconnected. From a pluralistic perspective of ESD, teaching students to confront tensions and conflicts and tackling issues with no single answer seems to be difficult. Since the ESD curriculum has been constructed through whole-school educational activities in Japan by linking it with other subjects and areas, utilizing integrated study periods, it is important to examine approaches to understanding the effectiveness of a whole-school approach of ESD.

1. Introduction
“All ESD activities contribute to the achievement of the SDGs, it continues to have particular relevance for the global education agenda enshrined in SDG 4, in which ESD has a distinct place. ESD is a key element of quality education. Its cross-cutting competencies in cognitive, socio-emotional and behavioural dimensions of learning bear relevance to all areas of education” [1]. After the end of DESD, evidence of the improvement of schools addressed ESD and its contribution to the quality of education will be more strongly emphasised. However, there is very little empirical evidence for the extent to which ESD has been implemented at the school level, which could provide a cross-regional discussion.

Sustainable development, the principal concept of ESD, was first widely defined in the Brundtland report entitled ‘Our common future’, as follows: ‘Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs’ [2]. This definition implies that there is a necessity of including all three dimensions (environmental, social, economic) of education (McKeown and Hopkins [3]) and focusing on their interrelationship, as well as their interactions over time and space.

In the outline of Education for Sustainable Development as a teaching tradition, Stables and Scott [4] and Öhman [5] identify three essential aspects of holism: connecting the environmental, social, and economic dimensions of Sustainable Development (SD) issues; integrating their past, present, and future implications; and focusing on their local, regional, and global nature.
In addition to holism, the second essential feature of ESD deals with the processes of teaching and learning. ESD focusses on the development of skills and action competence for sustainability; this pedagogy has been labelled pluralism. Thus, with holism and pluralism in mind, this article researches the contributing schools’ efforts concerning their implementation of ESD from the viewpoint of schoolteachers. Because there is very little empirical evidence for international comparison, this research digs deeper into the effects of a holistic ESD approach to content and a pluralistic ESD approach to teaching in the context of Japanese formal education. In addition, this research aims to clarify which barriers exist when ESD is addressed in schools.

2. Concepts of Holism and Pluralism

Prior to the promotion of Education for Sustainable Development (ESD), Environmental Education (EE) was often associated with a quest for a holistic worldview. There is a growing consensus that the holistic perspective of sustainable development (SD) should be applied in ESD. When we are looking at ESD, it is necessary to include all three dimensions equally and to focus on the interrelationship between ecological, economic, and social dimensions in a holistic perspective of Sustainable Development [6]-[9]. The UNESCO document ‘Framework for the UNDESD International Implementation Scheme’ outlines fifteen sub-themes of three dimensions in connection to the education for Sustainable Development: “(1) Socio-cultural perspectives-human rights, peace and human security, gender equality, cultural diversity and intercultural understanding, health, HIV/AIDS, and governance; (2) Environmental perspectives-natural resources (water, energy, agriculture, biodiversity), climate change, rural development, sustainable urbanisation, and disaster prevention and mitigation; (3) Economic perspectives-poverty reduction, corporate responsibility and accountability, and market economy” [1].

Each of these sub-themes are covered in ESD classrooms. However, holism refers not only to the treatment of those topics, but also refers to time and space, because development (SD) issues integrate their past, present, and future implications and focus on their local, regional, and global nature as well [5]. The essential feature of ESD which deals with the processes of teaching and learning is called pluralism. Essentially, ESD aims to facilitate learning in such a way that learners understand the world based on their own observations and develop competences to take action for sustainability.

The pluralistic approach is characterised by a striving to acknowledge and engage different perspectives, views, and values, and by recognizing and accepting our different standpoints through deliberative conversations [11]. This transformative pedagogy calls for learner-centred teaching approaches such as critical thinking, participatory decision making, value-based learning, multi-method approaches, and social learning.

![Figure 1. ESD’s holism.](image_url)
In addition, ESD is often viewed as an approach to teaching and learning that aims to build students’ abilities to focus on behavioural change. Mogensen and Schnack [12] further emphasise that “a key role of ESD in an action competence approach is to develop students’ ability, motivation, and desire to play an active role in finding democratic solutions to SD problems and issues. For this purpose, ESD builds on the strengths of joint, co-created solutions, independent and autonomous thinking, and learning to deal with the reality of change and uncertainty”.

![Figure 2. ESD’s pluralism.](image)

3. Students’ and teachers’ recognition of ESD

3.1. Students’ conscious recognition of ESD

Internationally, several surveys have focused mainly on the effects of environmental education (EE). Many studies also show that EE mainly influences their students’ environmental knowledge; it does not create a transformation of attitude and behaviour. Walshe [13] showed the impact and understanding of sustainable development of 12 to 13-year-old geography students in the UK. There was a wide range in the level of their understanding of the concept of sustainability. Pauw and Petegem [14], based on the research of 1,287 10–12-year-olds from 59 schools (38 eco-schools and 21 control schools), show that eco-schools mainly influence their students’ environmental knowledge but do not influence environmental attitude and behaviour. The same authors [15] show that the effect of environmental values on environmental behaviour is different across diverse cultural contexts from a massive research study with a total of 1,833 ten- to thirteen-year-old children from Flanders, Guatemala, and Vietnam. Berglund, Gericke, and Chang [16] indicate that “there are significant differences in sustainable consciousness between students from Swedish schools that teach with an ESD approach compared to students from regular schools. Furthermore, a significant difference between the two groups of students was found in the underlying economic dimension of sustainable consciousness. No significant differences were found in the environmental and social dimensions of sustainable consciousness”.

Pauw, Gericke, Olsson, and Berglund [17] gathered a large amount of data from 2,413 students from 51 schools across Sweden to study the effectiveness of ESD. Their results indicate that ESD can actually impact student outcomes in terms of their sustainable consciousness. The results of this study reveal the key role ESD plays in addressing SD, paving the way for a more sustainable future.
3.2. Teachers’ understanding of ESD

Studies that have looked at teachers’ conceptual understanding of ESD have shown that the ecological perspective is the most commonly recognised, while a relatively small number of teachers have a holistic understanding of ESD. Early in the ESD movement, Summers, Corney, and Childs [18] researched student teachers’ conceptions of sustainable development in UK. They showed that a large number of student teachers recognised the centrality of environmental (87%), economic (69%), and social (49%) factors. Öhman [5] found disciplinary differences amongst upper secondary teachers’ ways of conducting EE in Sweden. Social science teachers taught environmental issues to a higher extent than science teachers, while only 30% of language teachers taught environmental issues at all. In addition, many teachers did not teach according to an ESD tradition. Summers, Childs, and Corney [19] showed that schools in UK were not yet well developed as sites for the development of student teachers trained to teach ESD. For example, student teachers generally had a greater understanding of sustainable development than their mentors. For both students and mentors, there were significant gaps in the understanding of ESD compared with representations found in the literature. Corney [8] reported that for geography student teachers, there were three main areas of challenge: namely, challenges related to the complexity of subject matter, to teaching and learning approaches and strategies, and to differences between student teachers’ beliefs about education for sustainable development and the context for their teaching.

In addition to the research from Sweden and the UK, Spiropoulou et al. [20] studied Greek in-service primary teachers’ perceptions about environmental issues and attitudes toward SD. The analysis of data revealed that teachers held misunderstandings or misconceptions of the conceptual meaning of the terms “sustainability” and “renewable source of energy”. Borg et al. [21] “referred to the different ways that teachers with different backgrounds recognised sustainable development. The greatest uncertainty for teachers is related to the economic dimension of ESD. Science and social science teachers are critical of incorporating economic growth into the concept of sustainable development, while language, vocational, and esthetical–practical teachers are not incorporating it at all”. Borg, Gericke, Höglund, and Bergman [22] showed that “Swedish teachers were uncertain with respect to their understanding of all three dimensions”. They ranked their personal understanding of SD high, higher than assessments reported in studies in other Western European countries such as the UK. However, most teachers still had an understanding of SD in line with an EE-tradition.

These previous studies focused on three essential aspects of holism: connecting the environmental, social, and economic dimensions of sustainable development issues. For the students’ and teachers’ recognition, the effect that this type of education has on knowledge, attitude, and behaviour is emphasised. This previous research mostly focused on classroom studies or secondary school teacher perspectives. The results indicate that the ecological dimensions of ESD were most commonly identified among students and teachers. One thing to note is that there may be differences between how secondary school teachers from different disciplines and subjects understand sustainable development.

4. ESD in Japanese Education

During the Decade of Education for Sustainable Development (2005–2014), which was strongly supported by the Japanese government, in 2008, the Japanese Ministry of Education launched ‘The basic educational promotional plan of 2008’. This promotional plan positioned UNESCO-Associated Schools as centres for promoting ESD and gave support for the increase of UNESCO-Associated Schools in the global school network of UNESCO-leading ESD. This allowed UNESCO-Associated Schools in Japan to take part in efforts to develop the educational content and methods of ESD. After this initiative, the numbers of UNESCO-Associated Schools in Japan went from 24 in January of 2008 to 1,116 in May of 2019.
Figure 3. Breakdown of UNESCO associated schools in September 2019.

This Figure 3 shows that of the ESD schools in Japan, public school and compulsory schools are the majority, with 76 percent. Primary schools make up 52 percent of ESD schools. On the other hand, ESD is included as part of the description of all subjects in the curricula. The Revised National Curriculum Guidelines in 2008 contain a significant amount of content connected with ESD. ESD content is most noticeable in geography, civics, natural science, home economics, and physics.

However, most of the ESD in Japan is practiced during the integrated study periods rather than in core subjects. The integrated study periods were established when the Curriculum Guidelines, which are the national standards of the curricula in Japanese schools, were revised in 1998. “These study periods have provided space for teaching and learning approaches that encourage task-based inquiry learning, problem solving, and participatory learning, which are important components of pluralistic approaches of ESD” [1]. The curriculum of ESD has been constructed through whole-school educational activities by linking it with other subjects and areas (such as extracurricular activities); the so-called ESD calendar makes this whole school approach clear. Because of this situation, research on the Japanese viewpoint of ESD is needed; it will certainly require a different viewpoint from the European (e.g. Sweden, UK) concept of ESD, which is mainly focused on secondary education and individual teachers under different principles.

5. Research Questions
Despite a global commitment to ESD as a teaching approach, there is very little empirical evidence for international comparison. One thing that would be useful to compare is the extent to which ESD is implemented in the school and classrooms, and the effects ESD has on the school and students.

In Japan, ESD curriculum through whole school educational activities has been constructed mainly utilizing integrated study periods. With this in mind, this research digs deeper into the effects of ESD in the context of Japanese formal education. The research questions are therefore the effects of a holistic ESD approach to content and a pluralistic ESD approach to teaching in the context of Japanese formal education: What is the effect of ESD for the students and in the school from the viewpoint of schoolteachers?

6. Research Design
The purpose of this paper is to study the effect of ESD from the viewpoint of schoolteachers in Japan. In order to design an evaluative tool for ESD schools, I looked at Transfer 21 [23], which proposed the formulation of concepts for quality development in German schools. The catalogue of criteria, on the basis of which self-assessments were created, can be divided into nine quality areas; learning
culture, learning groups, competencies, school culture, opening of schools to the outside world, school management, school program, resources, and staff development. Another way to measure ESD in schools comes from an evaluation of sustainable schools in the UK known as the ‘S3: Sustainable School Self-evaluation’ [24]. The S3 allows for the evaluation of ESD schools’ performance across four key areas of performance and improvement; Ethos: characteristics of your school, Curriculum: teaching provision and learning, Campus: leadership and management, Community: engaging local people and partner.

Bringing together the key points of Transfer 21 and S3: Sustainable School Self-evaluation, the research employs 8 criteria; Improvement of students’ attitude and behaviour, Acquisition of ESD competencies, Recognition of the components for ESD, Improvement of teaching and learning method, Improvement of teaching and learning concepts, Improvement of the school organization, Engagement of the local partner, Teacher training. The following is the analysis of 5 parts of these criteria: Improvement of students’ capacity and behaviour, acquisition of ESD competencies, recognition of the components of ESD, improvement of teaching and learning concepts, and improvement of the school organisation with the question of the barriers of teaching ESD for the teachers. In the questionnaire, teachers are asked to grade different aspects of their school practice on a five-point scale.

Questionnaires were distributed in the various prefectures of the north-eastern part of Japan on July in 2014, 2015, 2016, and 2017. Because there are different teachers each year, the questionnaire respondents were made up of a mixture of teachers who are responsible for the practices of ESD. The target schools in this research—the UNESCO-Associated Project Network (ASPnet) schools—consisted of 3 kindergartens, primary schools, lower secondary schools, and upper secondary schools. Preschools were omitted from the analysis because educational system is completely different from that of other grades.

| Category            | 2014 (pilot) | 2015 | 2016 | 2017     |
|---------------------|--------------|------|------|----------|
| Pre-school          | 6            | 6    | 3    | 6        |
| Primary school      | 18           | 38   | 50   | 45       |
| Lower secondary school | 13         | 25   | 27   | 28       |
| Upper secondary school | 0           | 5    | 7    | 6        |
| Total               | 31           | 74   | 88 (1 invalid) | 85 |

7. Research Analysis

Through the three years of research, the same trend was shown for 3 years as was shown by the pilot research conducted in 2014. This research shows the effectiveness of the Japanese school enhancing ESD from the teachers’ perspective.

| Category                                      | Questionnaire                              | 2014 (pilot) | 2015 | 2016 | 2017     |
|-----------------------------------------------|--------------------------------------------|--------------|------|------|----------|
| Improvement of students’ reading and writing students’ capacity and behaviour | 3.29±0.59                                   | 3.26±0.56    | 3.18±0.59 | 3.32±0.73 |
| Improvement of students’ calculating skills   | 3.00±0.45                                   | 3.09±0.48    | 3.08±0.61 | 3.06±0.72 |
| Improvement of students’ thinking ability     | 3.87±0.62                                   | 3.85±0.63    | 3.76±0.59 | 3.90±0.62 |
| Improvement of students’ interest of study    | 4.13±0.62                                   | 3.90±0.60    | 3.95±0.65 | 4.01±0.61 |
| Improvement of students’ participation        | 4.00±0.58                                   | 3.93±0.61    | 3.95±0.67 | 3.97±0.62 |
| Improvement of students’ leadership           | 3.65±0.71                                   | 3.59±0.65    | 3.37±0.71 | 3.72±0.77 |
| Category                                      | Questionnaire                                                                 | 2014 (pilot) | 2015          | 2016          | 2017          |
|----------------------------------------------|-------------------------------------------------------------------------------|--------------|---------------|---------------|---------------|
| Improvement of students’ collaboration       |                                                                               | 3.94±0.68    | 3.99±0.59     | 3.95±0.68     | 3.97±0.68     |
| Improvement of students’ active participation in the ECO activities |                                                                               | 3.45±0.62    | 3.63±0.74     | 3.68±0.71     | 3.77±0.72     |
| 2 Acquisition of ESD competencies           | Critical thinking                                                             | 3.35±0.49    | 3.32±0.63     | 3.28±0.65     | 3.35±0.75     |
|                                              | Ability to forecast the future and plan                                       | 3.74±0.68    | 3.54±0.63     | 3.64±0.65     | 3.62±0.72     |
|                                              | Multi-faceted and comprehensive thinking                                     | 3.80±0.54    | 3.65±0.59     | 3.92±0.60     | 3.86±0.67     |
|                                              | Ability to communicate                                                       | 4.13±0.50    | 4.09±0.60     | 4.12±0.63     | 4.10±0.57     |
|                                              | Cooperative attitude                                                         | 4.29±0.69    | 4.31±0.55     | 4.21±0.65     | 4.25±0.52     |
|                                              | Respect for interconnectedness                                               | 4.16±0.64    | 4.10±0.60     | 4.07±0.56     | 4.04±0.69     |
|                                              | Attitude of proactive participation                                          | 4.06±0.57    | 3.97±0.60     | 4.01±0.62     | 4.06±0.58     |
| 3 Recognition of the components of ESD       | Diversity                                                                    | 4.16±0.92    | 4.04±0.70     | 4.25±0.54     | 4.26±0.66     |
|                                              | Interdependence                                                              | 4.39±0.56    | 4.27±0.61     | 4.32±0.58     | 4.38±0.59     |
|                                              | Finiteness                                                                   | 3.78±0.72    | 3.66±0.82     | 3.80±0.74     | 3.74±0.80     |
|                                              | Fairness                                                                     | 3.97±0.71    | 3.80±0.61     | 3.90±0.64     | 3.96±0.64     |
|                                              | Cooperation                                                                  | 4.42±0.50    | 4.37±0.60     | 4.41±0.52     | 4.38±0.59     |
|                                              | Responsibility                                                                | 4.23±0.67    | 4.16±0.59     | 4.19±0.61     | 4.17±0.68     |
| 4 Improvement of teaching and learning concepts | Adapting a viewpoint of sustainability for the future                       | N/A          | 3.99±0.66     | 4.17±0.60     | 4.14±0.69     |
|                                              | Utilizing multi-faceted and comprehensive methods                            | 3.91±0.60    | 3.78±0.59     | 3.85±0.69     | 3.90±0.67     |
|                                              | Adapting a global and local perspective                                      | 4.06±0.57    | 4.00±0.77     | 4.15±0.67     | 4.15±0.74     |
|                                              | Understanding different types of values which cause conflict                 | 3.48±0.67    | 3.45±0.74     | 3.57±0.77     | 3.36±0.84     |
|                                              | Discussing unanswerable topics on the issues of sustainability               | N/A          | 3.51±0.70     | 3.73±0.74     | 3.50±0.75     |
|                                              | Beyond knowledge transfer, challenging students to change values and behaviour| 4.06±0.51    | 3.84±0.61     | 3.92±0.60     | 3.86±0.68     |
| 5 Improvement of the school organisation     | Active use of school buildings and school yard                               | 3.48±0.72    | 3.51±0.78     | 3.65±0.76     | 4.14±0.69     |
|                                              | Respect for energy and water conservation in the school                      | 3.35±0.61    | 3.53±0.74     | 3.55±0.74     | 3.90±0.67     |
|                                              | Making an ESD educational plan utilizing the whole school approach           | 3.90±0.75    | 3.82±0.85     | 3.63±0.78     | 4.15±0.74     |
|                                              | Settlements with school board, making changes that engage parents of the school | 3.26±0.86    | 3.50±0.85     | 3.57±0.76     | 3.36±0.84     |
|                                              | Enhancing open school and collaboration with local organisations             | 3.54±0.86    | 3.73±0.81     | 3.96±0.77     | 3.50±0.75     |
|                                              | Engagement of local human resources and NPOs                                 | 4.26±0.73    | 4.01±0.86     | 4.06±0.72     | 3.86±0.68     |
|                                              | Increase of activities across classrooms and grades                          | 4.03±0.70    | 3.99±0.78     | 3.93±0.77     | 4.14±0.69     |
|                                              | School activities affecting parents and local communities                    | 3.61±0.61    | 3.40±0.67     | 3.45±0.72     | 3.90±0.67     |
Table 3. Effectiveness of Education for Sustainable Development by school level (Average of 2015-2017)

| Category | Questionnaire                                                                 | Primary         | Lower Secondary | Upper Secondary |
|----------|-------------------------------------------------------------------------------|-----------------|-----------------|-----------------|
| 1 Improvement of students' capacity and behaviour | Improvement of students’ reading and writing skills | 3.32±0.66       | 3.31±0.58       | 3.22±0.81       |
|          | Improvement of students’ calculating skills                                  | 3.11±0.65       | 3.10±0.54       | 2.89±0.83       |
|          | Improvement of students’ thinking ability                                     | 3.83±0.65       | 3.93±0.59       | 3.89±0.58       |
|          | Improvement of students’ interest of study                                   | 4.00±0.69       | 3.96±0.62       | 3.94±0.64       |
|          | Improvement of students’ participation                                       | 3.99±0.57       | 3.91±0.65       | 3.94±0.73       |
|          | Improvement of students’ leadership                                         | 3.53±0.76       | 3.83±0.68       | 3.78±0.65       |
|          | Improvement of students’ collaboration                                        | 3.91±0.74       | 4.07±0.57       | 3.89±0.58       |
|          | Improvement of students’ active participation in the ECO activities           | 3.77±0.77       | 3.61±0.64       | 3.50±0.62       |
| 2 Acquisition of ESD competencies               | Critical thinking                                                            | 3.25±0.68       | 3.34±0.67       | 3.72±0.75       |
|          | Ability to forecast the future and plan                                       | 3.50±0.68       | 3.70±0.68       | 3.78±0.65       |
|          | Multi-faceted and comprehensive thinking                                     | 3.73±0.71       | 3.87±0.56       | 4.00±0.59       |
|          | Ability to communicate                                                        | 4.07±0.67       | 4.10±0.57       | 4.33±0.69       |
|          | Cooperative attitude                                                          | 4.23±0.68       | 4.25±0.55       | 4.33±0.59       |
|          | Respect for interconnectedness                                                | 4.05±0.69       | 4.11±0.57       | 4.17±0.71       |
|          | Attitude of proactive participation                                          | 4.02±0.76       | 4.04±0.62       | 4.00±0.59       |
| 3. Recognition of the components of ESD         | Diversity                                                                    | 4.10±0.69       | 4.29±0.59       | 4.50±0.51       |
|          | Interdependence                                                               | 4.30±0.67       | 4.39±0.57       | 4.33±0.77       |
|          | Finiteness                                                                    | 3.78±0.83       | 3.69±0.73       | 3.78±0.73       |
|          | Fairness                                                                      | 3.98±0.69       | 3.90±0.62       | 3.61±0.61       |
|          | Cooperation                                                                   | 4.34±0.65       | 4.39±0.57       | 4.44±0.61       |
|          | Responsibility                                                                | 4.15±0.69       | 4.24±0.62       | 4.06±0.73       |
| 4 Improvement of teaching and learning concepts | Adapting a viewpoint of sustainability for the future                        | 4.10±0.70       | 4.11±0.59       | 4.22±0.73       |
|          | Utilizing multi-faceted and comprehensive methods                            | 3.96±0.67       | 3.92±0.62       | 3.64±0.45       |
|          | Adapting a global and local perspective                                        | 3.94±0.81       | 3.85±0.82       | 4.22±0.81       |
|          | Understanding different types of values which cause conflict                  | 3.45±0.79       | 3.35±0.83       | 3.61±0.85       |
|          | Discussing unanswerable topics on the issues of sustainability                | 3.52±0.72       | 3.55±0.79       | 3.83±0.92       |
|          | Beyond knowledge transfer, challenging students to change values and behaviour | 3.91±0.67       | 3.85±0.65       | 4.00±0.69       |
| 5 Improvement of the school organisation       | Active use of school buildings and school yard                                | 3.66±0.83       | 3.61±0.78       | 3.33±0.84       |
|          | Respect for energy and water conservation in the school                       | 3.65±0.79       | 3.39±0.73       | 3.59±0.70       |
|          | Making an ESD educational plan utilizing the whole school approach            | 3.95±0.81       | 3.59±0.80       | 3.39±0.98       |
|          | Settlements with school board, making changes that engage parents of the school | 3.62±0.82       | 3.34±0.77       | 3.11±0.90       |
|          | Enhancing open school and collaboration with local organisations              | 3.88±0.79       | 3.73±0.89       | 3.89±0.90       |
|          | Engagement of local human resources and NPOs                                  | 4.11±0.81       | 4.10±0.83       | 3.83±0.86       |
|          | Increase of activities across classrooms and grades                          | 3.95±0.78       | 4.03±0.89       | 3.61±0.78       |
|          | School activities affecting parents and local communities                     | 3.54±0.77       | 3.34±0.74       | 3.11±0.76       |
7.1. Improvement of Students' Capacity and Behaviour

In this questionnaire, the first category asked about student capacity and behaviour. We were looking for information about the improvement of students’ calculating, reading, and writing skills, and the question asked about the connection of ESD to traditional subject-based learning. The results show that ESD is not a concept which directly connects with the basic skills of traditional subject-based learning. Students’ reading and writing skills are not clearly connected with ESD; on the other hand, teachers reported that students’ thinking ability and motivation are improved by ESD.

An important aspect of ESD is the concept of a participatory and active citizenship that builds on the strengths of joint, co-created solutions. Category 1 was also concerned with student behaviour, participation, leadership, collaboration, and participation in eco-activities. In answering these questions, teachers reported that participation and collaboration attitudes of students are generally improved.

7.2 Acquisition of ESD Competencies

The learning process of ESD is intended to be transformative, mediated by a critical, open-ended, pluralistic, and democratic approach. In the questions of Category 2, these seven competencies of ESD are those that were identified by the National Institute for Educational Policy Research (NIER) in Japan [25].

Critical thinking is the core competency for striving to acknowledge and engage different perspectives, views, and values, and recognizing and accepting our different standpoints of SD. From the teacher’s reports, the rate of critical thinking is low, especially for primary school. On the other hand, this data shows that students’ ability to communicate and cooperative attitude are quite good.

7.3 Recognition of the components of ESD

The questions in category 3 are also defined by the National Institute for Educational Policy Research [25] as the basic component of sustainable development. Recognition of the role of finite environmental resources and fairness to future generations [26] are essential components of ESD; however, concerns about the finiteness and fairness are not highly developed in students, in contrast to interdependence and cooperativeness, which are consistently highly ranked.

7.4 Improvement of Teaching and Learning Concepts

One of the most important subjects of ESD is the understanding of the complex nature of sustainable development. ESD was developed using different sources reflecting different perspectives, and thus includes consideration of social and political issues together with economic and environmental concerns (Holism). ESD in particular relates to differing educational ideologies and has implications for effective student learning. In addition, ESD is often viewed as an approach to teaching and learning that aims to build abilities to focus on behavioural change (Pluralism). These questions were created to ask about the specific ideology of ESD. The questions below are classified as either relating to Holism (HL) or to Pluralism (PL): Adapting a viewpoint of sustainability for the future (HL), Utilising multi-faceted and comprehensive methods (PL), Adapting global and local perspectives (HL), Containing different types of values which cause conflict (PL), Discussing unanswerable topics on sustainability issues (PL), Challenging value and behaviour changes beyond knowledge transfer (PL).

The data shows that the pluralism concepts of ESD, teaching students to confront tensions and conflicts and tackle issues with no single answer, seem to be difficult, especially for primary school students. Global and local perspectives were gained by the students in each type of school. In 2017, this question was asked divided in Two domains: local and global. Thus, ESD seems to be more focused on local rather than on global issues, especially for the primary and lower secondary schools.
### Table 4. Adaptation of local and global perspective (Average of 2017).

| Perspective                      | Primary          | Lower Secondary | Upper Secondary |
|----------------------------------|------------------|-----------------|-----------------|
| Adapting a local perspective     | 4.18±0.75        | 4.25±0.64       | 3.50±0.84       |
| Adapting a global perspective    | 3.45±0.76        | 3.79±0.85       | 4.50±0.84       |

7.5 Improvement of School Organisation

Whole-school approaches recognise that sustainability is relevant to all aspects of school life, including in formal curricula and hidden curricula, school leadership and management, and teacher development. Regarding school organisation, the contents that are considered to be improvements are the adaptation of a whole school approach, the opening of a school, and the engagement of local human resources.

The Figure shows that creating an ESD educational plan that utilises a whole school approach is easier for primary schools (3.95) than for upper secondary schools (3.39); lower secondary schools are in the middle (3.59). This research shows that Engagement of local human resources and an increase of activities across different classrooms and grades are a clear result of enhanced ESD. The effect of the engagement of student parents is not clear. Legault and Pelletier [27] and Volk and Cheak [28] indicate that no significant effects were found in terms of ecological knowledge, competence, importance, motivational subtypes, and behaviours of student parents. We found the same results on the effect of environmental education as did.

7.6 Correlation test results

![Correlation test results](image)

For further analysis, the collected data from 2015 to 2017 were downloaded into IBM SPSS Statistics version 20. The results presented in this article are based on Pearson’s correlation test for analyses of each of the 5 categories.

Correlation describes the strength of a linear relationship between two variables. The intermediate correlation between Cooperative attitude (Competency) and Respect for interconnectedness (Competency)
interconnectedness (Competency) is \((r=.644, p<.001)\), Ability to Communicate (Competency) is \((r=.621, p<.001)\), Cooperation (Components) is \(r=.514(p<.001)\) and Collaboration (Attitude) is \((r=.501, p<.001)\). Respect for interconnectedness (Competency) shows an intermediate correlation with Proactive participation (Attitude) \((r=.525, p<.001)\). These result show that students’ collaboration, cooperativeness, cooperative attitude, and ability to communicate are interconnected.

7.7. **Barriers for the teachers**

The above data show that teachers’ recognition about the effectiveness of ESD in Japan is relatively positive and has been across all dates. The next question pertains to the difficulty and barriers which exist for the enhancement of ESD. Borg’s study [16] showed a total of 90% of respondents stating that they were passionate advocates or thought that it was a good thing. “Despite this, more than half of the teachers (55%) felt that they had difficulties integrating SD into their teaching. The most common obstacles reported were that they: (a) lacked inspiring examples of how to include SD issues in their teaching (29%); (b) lacked necessary expertise on SD (27%); (c) lacked time to implement necessary changes to their courses (15%); and (d) lacked sufficient support from the school management (7%). Some teachers also felt that SD was not relevant to their subject (14%)”[2].

The following table shows the result of the barriers for the teachers in their implementation of ESD in 2015, 2016 and 2017:

| Table 5. Barriers to Education for Sustainable Development |
|----------------------------------------------------------|
| 2015           | 2016           | 2017           |
|----------------|----------------|----------------|
| The concept of ESD is so comprehensive, everything is involved | 3.55±1.15    | 3.63±0.99    | 3.58±1.05    |
| The aims and purpose of ESD is not clear | 3.70±1.07    | 3.58±1.13    | 3.58±1.09    |
| School has many research topics, ESD is one of them | 3.66±1.14    | 3.60±1.10    | 3.66±1.18    |
| Only few numbers of teachers promote ESD | 3.00±1.13    | 3.04±1.13    | 3.08±1.20    |
| Not enough time for the enhancement of ESD | 3.32±1.03    | 3.29±1.09    | 3.37±1.25    |
| Not enough funding support for the enhancement of ESD | 3.38±0.96    | 3.28±1.13    | 3.04±1.10    |

For effective teaching of ESD, it is necessary to include all three dimensions (ecological, economic, and social) equally and to focus on their interrelationship from a holistic perspective of Sustainable Development. Although holistic and pluralistic perspectives are special characteristics of ESD, a confusion remains of how to integrate ESD into school practice. In addition, ESD is not treated as a top priority in several of the educational topics in school. A comprehensive ESD approach to the issues will address Borg’s [16] abovementioned barriers: a lack of inspiring examples of how to include SD issues in their teaching; a lack of necessary expertise on SD; an irrelevancy of SD to a given subject.

For effective teaching of ESD, it is necessary to include all three dimensions (ecological, economic, and social) equally and to focus on their interrelationship from a holistic perspective of Sustainable Development. Although holistic and pluralistic perspectives are special characteristics of ESD, a confusion remains of how to integrate ESD into school practice. In addition, ESD is not treated as a top priority in several of the educational topics in school. A comprehensive ESD approach to the issues will address Borg’s [16] abovementioned barriers: a lack of inspiring examples of how to include SD issues in their teaching; a lack of necessary expertise on SD; an irrelevancy of SD to a given subject.

8. **Conclusion**

Until now, there has been very little empirical evidence for the extent to which ESD is implemented in the school; this paper adds to the current knowledge by presenting results from a regional survey conducted in Japan. Pauw et al. [27] indicate that ESD can actually impact student outcomes in terms of their sustainability consciousness. The questionnaires’ analysis shows that teachers’ beliefs about the effectiveness of ESD in Japan is relatively high. This research also revealed that in Japan, students’
collaboration, cooperativeness, cooperative attitude, and ability to communicate are interconnected. In the integrated study periods, and by engaging local human resources, cooperativeness, cooperative attitude, and ability to communicate are promoted. The goals of ESD are to build on the strengths of cooperation, co-create solutions, and learning to deal with the reality of change. These goals are critical in the context of Japanese public education; In other words, this tendency is recognised as a special characteristic of the promotion of ESD in Japan.

However, from the pluralistic perspective of ESD, teaching students to confront tensions and conflicts and tackling issues with no single answer seems to be difficult. Corney [7] suggested that, as a challenge for teachers, appreciation of differing interpretations of the aims and purpose of ESD (particularly relating to differing educational ideologies and the implications for student learning, which is especially related to the concepts of action competence and behavioural change) should be emphasised. This issue still exists as a challenge for Japanese teachers when they address ESD. For the next step of implementing ESD, the development of skills, methods, and materials which deal with complexity, uncertainty, and the conflict of SD issues, as well as those which deal with the aims and purpose of ESD, are required for teachers.

Previous studies focused on three essential aspects of holism: connecting the environmental, social, and economic dimensions of sustainable development issues. From the aspect of pluralism, the effect of ESD on knowledge, attitude, and behaviour is emphasised. These previous studies mostly focused on secondary school teacher perspectives and note the differences in how secondary school teachers from different disciplines and subjects understand sustainable development. However, as mentioned above, ESD should be interdisciplinary, holistic, and participatory, with ‘learning for sustainable development embedded in the whole curriculum, not as a separate subject’ [1].

Since the ESD curriculum has been constructed through whole-school educational activities in Japan by linking it with other subjects and areas such as moral education and extracurricular activities, utilising integrated study periods, previous research does not relate well to the Japanese situation. Further research should focus on approaches to determine the effectiveness of a whole-school approach to ESD.

Acknowledgments
This work was supported by JSPS Grant-in-Aid for Scientific Research (C) Grant Number J150100020. I would like to thank Editage (www.editage.jp) for English language editing.

References
[1] UNESCO 2005 UN decade of education for sustainable development 2005-2014 (International implementation scheme) (Paris: UNESCO)
[2] WCED 1987 Chapter 2 Report of the World Commission on Environment and Development: Our Common Future http://www.un-documents.net/wced-ocf.htm (accessed 06.06.19)
[3] McKeown R, and Hopkins C 2003 EE / ESD: defusing the worry Environ. Educ. Res. 9117
[4] Stables A, and Scott W 2002 The Quest for Holism in Education for Sustainable Development, Environ.l Educ. Res. 8 53
[5] Öhman, J 2004 Moral perspectives in selective traditions of environmental education: conditions for environmental moral meaning-making and students’ constitution as democratic citizens. Learning to change our world? Swedish research on education and sustainable development Lund: Studentlitteratur 33
[6] Gough S 2002 Right Answers or Wrong Problems? Towards a Theory of Change for Environmental Learning The Trumpeter 18 1
[7] Scott W, and Gough S 2003 Sustainable Development and Learning: Framing the Issues (London: Routledge/Falmer)
[8] Corney G 2006 Education for Sustainable Development: An Empirical Study of the Tensions and Challenges Faced by Geography Student Teachers Inter. Res. Geogr. Environ. Educ. 15 224
[9] Summers M, and Childs A 2007 Student Science Teachers’ Conceptions of Sustainable Development: An Empirical Study of Three Postgraduate Training Cohorts. *Res. in Sci. and Tech. Educ.* **25** 307

[10] UNDESD International Implementation Scheme 2006
http://unesdoc.unesco.org/images/0014/001486/148650E.pdf. (Accessed 06.06.19).

[11] Rudsberg K, and Öhman J 2010 Pluralism in Practice: Experiences from Swedish evaluation, School Development and Research *Environ. Educ. Res.* **16** 95

[12] Mogensen F and Schnack K 2010 The action competence approach and the ‘new’ discourses of Education for Sustainable Development, competence and quality criteria *Environ. Educ. Res.* **16** 59

[13] Walshe N 2008 Understanding Students’ Conceptions of Sustainability *Environ. Educ. Res.* **14** 537

[14] Boeve-de Pauw J and van Petegem P 2011. The Effect of Flemish Eco-schools on Student Environmental Knowledge, Attitudes and Affect *Int. J. of Sci. Educ.* **33** 1513

[15] Boeve-de P J and Van Petegem P 2013 The Effect of Eco-schools on Children’s Environmental Values and Behaviour *J. Biol. Educ.* **47** 96

[16] Berglund T, Gericke N and Chang-Rundgren S-N 2014 The Implementation of Education for Sustainable Development in Sweden: Investigating the Sustainability Consciousness among Upper Secondary Students *J. Res. Sci. Technol. Educ.* **32** 318

[17] Boeve-de Pauw J, Gericke N, Olsson D and Berglund T 2015 The Effectiveness of Education for Sustainable Development *Sustain.* **7** 15693

[18] Summers M, Corney G, and Childs A 2004 Student Teachers’ Conceptions of Sustainable Development: The Starting points of Geographers and Scientists *Educ.l Res.* **46** 163

[19] Summers M, Childs A, and Corney G 2005 Education for Sustainable Development in Initial Teacher Training: Issues for Interdisciplinary Collaboration *Environ. Educ. Res.* **11** 623

[20] Spiropoulou D, Antonakaki T, Kontaxaki S, and Bouras S 2007 Primary Teachers’ literacy and attitudes on Education for Sustainable Development *J. of Sci. Educ. and Techn.* **16** 443

[21] Borg C, Gericke N, Höglund H and Bergman E 2012 The Barriers Encountered by Teachers Implementing Education for Sustainable Development: Discipline Bound Differences and Teaching Traditions *Res. Sci. Technol. Educ.* **30** 185

[22] Borg C, Gericke N, Höglund H, and Bergman E 2014 Subject- and Experience-bound Differences in Teachers’ Conceptual Understanding of Sustainable Development *Environ. Educ. Res.* **20** 526

[23] The Transfer-21 Programme’s ‘Quality and Competences’ working group 2007 *Developing Quality at “ESD Schools” Quality Areas, Principles and Criteria* Berlin pp38
http://www.transfer-21.de. (Accessed 06.06.19).

[24] “S3: Sustainable School Self-evaluation.” 2011
https://www.newcastle.gov.uk/wwwfileroot/legacy/childrensservice/Sustainable_school_self_evaluation.pdf. (accessed 06.06.19)

[25] NIER 2012 *The research about the Education for Sustainable Development in the school*, National Institution of Education Policy Research

[26] Weiss B 1992 In Fairness to Future Generations and Sustainable Development *American University Int. Law Review* **8** 1

[27] Legault L, and Pelletier G 2000 Impact of an Environmental Education Program on Students’ and Parents’ attitudes, Motivation, and Behaviors *Canadian J. Behav. Sci.* **32** 243

[28] Volk T, and Cheak J 2010 The Effects of an Environmental Education Program on Students, Parents, and Community *J. of Environ. Educ.* **34** 12