Implementation of education for sustainable development and pupils’ sustainability consciousness in Adiwiyata School and ESD-based school

R S Suwarto*, Y Sanjaya, and R Solihat*

Departemen Pendidikan Biologi, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia

*rimasuwartiningsih@upi.edu, rinisolihat@upi.edu

Abstract. Education for Sustainable Development (ESD) is important to be developed in Indonesia to support the achievement of Sustainable Development Goals (SDGs). The lack of identification in implementing ESD lead to the lack of a representation of ESD in Indonesia. This research aims to identify and to analyze the ESD implementation models that are applied in Adiwiyata school and ESD-based school in Indonesia and how the pupils’ Sustainable Consciousness are. Respondents involved in this studies are 27 pupils from both schools. Observation, interview and SC Likert-scale questionnaire with 51 statements were used as the instruments. The questionnaire consisted of environmental, social, and economic dimensions that considered pupils' knowlingness, attitude and behaviour. The results show that the ESD implementation model that refers to Burmeister & Eilks (2012) conducted by Adiwiyata and ESD schools consisted of 2 models. Model 2 with Adding Sustainable Science as Content in the Science and Technology Curriculum and model 4 with Science Education as a Part of ESD-Driven School Development. The pupils’ SC in the environmental dimensions of pupils in Adiwiyata schools have significant different with ESD-based schools. But, for the results of the pupils’ SC in the Economic and Social dimension have no significant different.

1. Introduction

Nowadays many environmental, economic and social problems occur, for example the problems that occurred in Indonesia regarding environmental damage. Problems such as poverty level and low education level are the main factors that cause the environmental damage. In fact, in the field of education especially in schools, pupils are not encouraged to make efforts to reduce the impact of these problems [1]. This is due to the lack of education that focuses on sustainable practices that are directly implemented in schools. United Nation has identified the lack of sustainable education so that it created an agreement forum to support the national development policy which is now known as Sustainable Development Goals (SDGs) which consists of 17 objectives covering the economic, social, and environmental fields [1]. The UN General Assembly also made further idea, called Education for Sustainable Development (ESD) to be realized in 2030 [2]. ESD aims to ensure that all pupils acquire the knowledge and skills needed to promote sustainable development. The purpose of establishing ESD is as a form of follow-up from SDGs, and it is considered to promote the achievement of SDGs in the education field [3].

ESD in Indonesia has existed for a long time in the Adiwiyata program implemented by the government from 2006. Regulation of the Minister of Environment that schools must be good and ideal
places to acquire all knowledge and various norms and ethics that can be the basis for humans to achieve welfare and the ideals of sustainable development. The Adiwiyata Program is an award given to schools that have actively participated in implementing the ideas according to the regulation. The lack of studies that identify whether Adiwiyata schools have supported ESD encourages researchers to conduct a research under this theme. In addition, researchers are also interested in researching ESD-based schools that have not existed for a long time in Indonesia. This research can help both schools and government in making decisions whether the implementation of ESD has been carried out as expected or not. It is also able to give an idea whether pupils have actively participated in simple research and projects to improve their knowledge, attitudes, and behavior towards the success of ESD and SDGs [4]. Therefore the researchers were intrigued to further explore about a picture of the ESD implementation in Adiwiyata school and in ESD-based school, and also about pupils’ SC in Indonesia.

2. Method
The method used in this research was descriptive method. This research was intended to understand the process and phenomena experienced by research subjects holistically [5]. In this study, researchers did not provide any treatment. The field condition was adjusted to the real condition at schools so that they can provide a real picture of ESD implementation in both Adiwiyata and ESD-based schools. The research participants were pupils at Adiwiyata Junior High School and ESD-based Junior High School. The location of the school in the study was selected by applying convenience sampling. The location of the study was conducted in two schools that implemented ESD. The reason chose one of the adiwiyata and ESD-based schools was because they both conducted programs related to ESD for three years in a row. The total sample of pupils in Adiwiyata school was 20 people while in ESD-based school was 7 people.

The implementation of ESD was based on the implementation of programs related to ESD in both schools by observation, and interview. Program implementation data were analyzed and categorized based on ESD implementation models that refer to Burmeister & Eilks [6]. The ESD implementation model will be further explained in table 1.

Table 1. Types of ESD Implementation Models

| Types of Model | Description |
|----------------|-------------|
| 1              | Adopting Principles from Sustainable Practices in Science and Technology for Hands-on Science Education Laboratory Work |
| 2              | Adding Sustainable Science as Content in the Science and Technology Curriculum |
| 3              | Using Controversial Sustainability Questions for the Socio-scientific Issues Driven Science Education |
| 4              | Science Education as a Part of ESD-Driven School Development |

Pupils’ SC were measured by using a Likert-scale questionnaire consisting of 51 statements. The SC questionnaire was adapted and modified from a questionnaire proposed by Olsson [7] which aims to measure pupils’ SC viewed from the environmental, economic and social dimensions that consider knowingness, attitude and behaviour of pupils towards the 17 SDGs. The data from the questionnaire were analyzed using the IBM SPSS Statistics 21 application. The data were processed by using the prerequisite test consisting of shapiro-wilk normality test based on a large number of samples (< 30), levene’s homogeneity test and independent t-test to find the mean difference between those two schools.

3. Result and Discussion

3.1 ESD Implementation in Adiwiyata School and in ESD School
School programs related to ESD as ESD implementation in Adiwiyata School and ESD-based school are diverse. School program data were analyzed and categorized based on ESD implementation models that refer to Burmeister & Eilks [6]. The programs in both schools are listed in the table 2.
| School               | Programs                                      | Implementation Models |
|---------------------|----------------------------------------------|-----------------------|
| Adiwiyata School    | Environment based curriculum                 | Model 1: - Model 2: √ Model 3: - Model 4: - |
|                     | Komunitas Pelajar Peduli Lingkungan (KPPL)    |                       |
|                     | Gerakan menggunakan Misting dan Tumbler (GMT)|                       |
|                     | Plastic Waste Recycle                        |                       |
| ESD-based School    | ESD-based school curriculum                  | Model 1: - Model 2: √ Model 3: - Model 4: √ |
|                     | Project FIDS                                  |                       |

Based on the table 2, show that the Adiwiyata school implemented ESD in model 2 with adding sustainable science as content in the science and technology curriculum. Model 2 in Adiwiyata School with develop national curriculum with adding knowledge and value about environment. It was proven in the lesson plan (known as RPP in Indonesian language) of natural science, especially biology. However, it only included environmental content which was one of the three dimensional pillars of the SDGs. The social and economic dimensions were not mentioned in the lesson plan. Learning observation results also show that during learning and teaching activities, the teacher did not forget to associate environmental awareness at the beginning, during the process and at the end of learning. The results of interview with pupils reveal the same thing that was done by all teachers in learning activities.

Adiwiyata School also implemented ESD by using model 4. Model 4 is Science Education as a Part of ESD-Driven School Development. Adiwiyata School developed extracurricular activities that were required for every pupil named Kegiatan Pelajar Peduli Lingkungan (KPPL). This extracurricular activity is expected to become one of the school organizations that facilitate pupils to explore and actively participate in raising awareness of all school community to protect the environment. It certainly becomes one of the programs that can directly reflect science education especially biology regarding the implementation of ESD that is carried out by the school especially in the environmental field. KPPL itself has several activities such as recycling plastic waste into pupils’ innovative creation. In addition, school management develop a program that called Gerakan menggunakan Misting dan Tumbler (GMT). This program must be carried out by every school member as a habit of reducing plastic waste.

ESD-based schools also using model 2. Model 2 can be investigated from the learning process carried out in classroom. For each year of learning at all levels, several SDGs indicators must be selected to be included in each learning material. By applying this policy, it is expected that the school is able to include all 17 SDGs in each material in one academic year. For example, the goal number 3 which is Climate Action is selected on global warming material so that the goal must be used or be included as content connected with the material. After analysing it further, SDGs indicators was not actually written in the lesson plan, but it was included in the pupil assessment journal and the learning process. The results of learning and teaching activities observation also show that the teacher linked Biology materials with relevant SDGs indicators.

ESD schools also implemented ESD by using model 4. The program was included in the project activities carried out by pupils every month. The program aims to make pupils able to contribute products of project results in providing solutions to problems related to learning material and to problems related to Sustainable Development (SD). The project is divided into four stages called FIDS. FIDS stands for Feel-Imagine-Do-Share. In the feel stage pupils are invited to investigate the background of problems related to learning materials and SD that must be solved though project activities. In imagine stage, pupils find data on the problems raised, provide alternative solutions to solve the problems and set project goals. In the do stage, pupils directly execute the ideas arranged under the
approval of the school. In the share stage, at the end of the month pupils are expected to be able to share their knowledge with the target projects that have been planned at the beginning to solve problems.

In both schools, they actively carried out participatory program activities in order to support ESD. This is indeed important considering that SD is as an approach to action competency so that empowering pupils to take action on complex problems related to SD [8] is absolutely appropriate. Adiwiyata schools whose organizational structure, teachers, and schools implement an ESD-based implementation strategy of awards by obtaining external general quality [9]. Adiwiyata School is an award that is expected to be able to support policies based on ESD, especially on environmental activities from the government. It is different from ESD-based schools that implement interdisciplinary ESD implementation strategies in combination with internal general quality support [9] which is indeed initiated by the schools themselves. all ESD institutional approach initiatives are expected to be a bridge to broader collaboration between school institutions and the community [10].

Besides the habit or participatory action, the activities that link learning materials with ESD problems implemented in a project in ESD-based Schools demonstrating in biology or science education shows great potential for increasing the level of pupils’ skills in participatory learning [11]. However, in learning activities in both schools, it was found that the learning method used consisted of questions and answers and pupils' presentations on the materials being taught was just slightly related to SD. Pupils were not given the opportunity to give an overview of SD. Participatory methods need to be added to support the development of ESD during learning process. This participatory method tends to allow pupils to develop, to express and to justify their own views on sustainability, and it also helps them to make connections between school learning and everyday life [12].

3.2 Pupils’ Sustainability Consciousness

Questionnaire data for pupils’ SC were seen based on knowingness, attitude, behavior (KAB) data on each dimension. The researchers conducted prerequisite tests on the results of the questionnaire by applying the shapiro-wilk normality test. The results are described in the following table 3.

| School              | Data          | Shapiro-Wilk Absolute | Df  | Sig. (p) | Conclusion |
|---------------------|---------------|-----------------------|-----|----------|------------|
| Adiwiyata School    | Environmental KAB | .131                  | 20  | .200*    | Normal     |
|                     | Social KAB    | .188                  | 20  | .063     | Normal     |
|                     | Economic KAB | .176                  | 20  | .106     | Normal     |
| ESD-based School    | Environmental KAB | .230                  | 7   | .200*    | Normal     |
|                     | Social KAB    | .224                  | 7   | .098     | Normal     |
|                     | Economic KAB | .282                  | 7   |           | Normal     |

The normality test in table 2 shows that all p(sig.) > 0.05 so that H₀ is rejected, and it can be interpreted that the data is normally distributed. Furthermore, the homogeneity test results data were tested by using levene’s homogeneity test as a further prerequisite test. The Homogeneity test results show that not all data are equal or homogenous. Subsequent test to distinguish data groups from environmental, social, and economic dimensions is used T-test. T-test can still be done even though the data is not partially homogeneous by looking at its not assumed equal variances provided as long as the absolute prerequisite test of a normally distributed set of data is met. The t-test results are shown in table 5 as follows.
Table 4. Pupils’ Sustainability Consciousness T-test Results

| Variable                  | T-count | T-table | Df | Significance Level | Conclusion     |
|---------------------------|---------|---------|----|--------------------|----------------|
| Environmental KAB         | 2.601   | 1.708   | 25 | 0.05               | Significant    |
| (Equal variances assumed) |         |         |    |                    |                |
| Social KAB                | 0.365   | 1.708   | 25 | 0.05               | Not Significant|
| (Equal variances not assumed) |       |         |    |                    |                |
| Economic KAB              | 1.278   | 1.708   | 25 | 0.05               | Not Significant|
| (Equal variances not assumed) |       |         |    |                    |                |

The results of the t-test show that there were significant differences ($t = 2.601$ p(sig.) > 0.05) in the environmental dimension of KAB. However in the social ($t = 0.365$ p(sig.) < 0.05) and economic dimensions ($t = 1.278$ p(sig.) < 0.05) of KAB, there were no significant differences between the two schools. SC is not intended to see whether good or not pupils’ knowledge, attitude and behavior in a dimension. However, SC here is to provide an opportunity to see SD from all dimensions as a complex concept, and not only as separate dimensions and aspects [7]. Thus it can give an idea whether there is a gap between pupils’ awareness and the goals in SDGs.

The results show that the pupils of Adiwiyata School have significant different awareness regarding the KAB in environmental dimension than the pupils of ESD-based School. The findings from the observation of teaching and learning activities in Adiwiyata School also demonstrate that there was indeed instilled in the environmental education at the beginning, during and at the end of the teaching and learning process. The teacher connected the learning material of Natural Sciences, specifically Biology, which is the sub-chapter of global warming, with the real condition of environmental problems around the school. The implementation of the value of environmental care in Adiwiyata School during learning biology will give a good effect on pupil attitudes [13]. The application of learning environmental approaches also supports pupils’ environmental awareness [14].

The results of observation in learning process of Natural Sciences, specifically Biology, in ESD-based school show that it was indeed instilled in not only the environmental problems but also the social and economic problems. However, the results indicate that there is no difference between ESD-based school and Adiwiyata school in those dimensions. Other finding supports that pupils are not familiar with economic and social issues. Pupils’ awareness of economic and social issues tend to be low [7]. However in the Curriculum Framework for Sustainable Development Goals, it is stated that ESD implementation will be successful if the environmental, economic and social problems can be related to each other in order to increase the knowledge supported by the holistic approach. Those three dimensions are keys to achieve SDGs, with education and learning as the main element of ESD [15]. This finding illustrates that it is essential to further follow-up the ESD implementation in schools in order to optimize it. This issue needs to be considered by the schools and government in making any decision in order to achieve the success of ESD in Indonesia in the future.

The limitation of this research is the time in researching the implementation of ESD in schools. It would be better in the future researchers to examine it in a longer period of time. This is useful to better illustrate the success and periodic evaluation of ESD implementation in schools. In addition, the lack of identification of each student's character and cultural background might have an impact on students' SC. The cultural background of each student might be developed to identify the factors that influence SC in the future. Thus, the results of the study not only describe the students’ SC but are more comprehensive with a discussion of the factors that affect the student's SC.
4. Conclusion
The ESD implementation model implemented by Adiwiyata school and ESD-based schools consists of 2 models. Model 2 with Adding Sustainable Science as Content in the Science and Technology Curriculum and model 4 with Science Education as a Part of ESD-Driven School Development. The results of the pupils’ Sustainability Consciousness in the environmental dimensions of pupils in Adiwiyata schools have significant different than those who are in ESD-based schools. But, for the results of the pupils’ Sustainability Consciousness in the Economic and Social dimension have no significant different.

5. References
[1] Ali M 2018 Curriculum Development for Sustainability Education, *Curriculum Development for Sustainability Education* (Bandung: UPI Press) p 1
[2] UNESCO 2017 Education for Sustainable Development Goals Learning Objectives (Paris: the United Nations Educational, Scientific and Cultural Organization)
[3] Nguyen T P 2019 Searching for education for sustainable development in Vietnam, *Environ. Educ. Res.* 25 991-1003
[4] Karyanto P 2019 Non-Curricular Strategies in the Implementation of Education for Sustainable Development in Three Prominent Green Schools in Indonesia, *J. of Physics: Conf. Series* 1241:012035
[5] Creswell J W 2014 *Research design: qualitative, quantitative, and mixed methods approaches* 4th ed. Thousand Oaks (California: SAGE Publications)
[6] Burmeister M and Eilks I 2012 An understanding of sustainability and education for sustainable development among German student teachers and trainee teachers of chemistry, *Chemistry Educ. Res. and Practic* 13 93-102
[7] Olsson D, Gericie N and Chang Rundgren S N 2016 The effect of implementation of education for sustainable development in Swedish compulsory schools – assessing pupils’ sustainability consciousness, *Environ. Educ. Res.* 22 176-202
[8] 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 59–74.
[9] Mogren A, Gericie N and Hans-Åke Scherp 2018 Whole school approaches to education for sustainable development: a model that links to school improvement, *Environ. Educ. Res.* 24 2-24
[10] UNESCO 2014 *UNESCO Roadmap for Implementing the Global Action Programme on Education for Sustainable Development*. (Paris: United Nations Educational, Scientific and Cultural Organisation)
[11] Eilks I 2002 Science Education and Education for Sustainable Development – Justifications, Models, Practices and Perspectives, *Chemistry Education Research and Practice* 3 67-75
[12] Scoullos M 2013 Learning for and about sustainability in higher education – a regional perspective based on experiences from the Baltic and the Mediterranean, *Education for sustainable development in biosphere reserves and other designated areas. A Resource book for educators in South-Eastern Europe and the Mediterranean*. (Greek: UNESCO)
[13] Muflihaini M A and Suhartini 2018 Implementation of environmental care character education value on biology subject through adiwiyata, *J. Prodi Pendidikan Biologi* 7 2
[14] Pratami D A and Umami M 2018 Implementation of Garden-Based Learning (GBL) to Establish Awareness Environmental and Conservation Skills on Students, *Prosiding Biology Educ. Conf.* 15 1
[15] Osman A, Ladhani S, Findlater E and McKay V 2017 *Curriculum Framework for the Sustainable Development Goals First Edition*. (London: The Commonwealth)
Acknowledgments
We would like to thank the headmaster, teachers and staff of Adiwiyata junior high school in Bandung and ESD-based junior high school in Sumedang for helping and giving permission to conduct this research.