Implementation of education for sustainable development to enhance Indonesian golden generation character

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Abstract. The study aims to measure the improvement of Indonesian golden generation character after implementation of education for sustainable development (ESD). The data were collected by using the character self-assessment that given to senior high school students in nine provinces spread in the western, central and eastern regions of Indonesia. The instrument was adapted from character education indicators by Ministry of Research, Technology and Higher Education and the combination of sustainable development learning indicators. The result shows that mostly the character aspects of Indonesian golden generation can be enhanced. ESD character model can develop several characters of students but still need more time to enhance student’s critical attitude and creativity. Besides, it can inferred that implementation of ESD in science education, biology, physics, and chemistry subject can be recommended by using several learning models, of which one of them is ESD character model.

1. Introduction
At present, the Indonesian Government is preparing a golden generation of 2045. This preparation is also manifested in the fields of education and other supporting sectors of human resources. Various phenomena and events related to natural disasters, moral degradation and economic downturn in Indonesia are the main factors affecting all parties, especially the Indonesian Government. The concept of education for sustainable development provides a new perspective in realizing a better Indonesia. The educational development perspective is not only to develop intellectual aspects, but also the character, moral, social and physical generation in other words creating a full human. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs [1, 2].

The concept of education for sustainable development is a real manifestation of pedagogy for the concept of sustainable development. Education for sustainable development empowers everyone to determine decisions for environmental integrity, economic feasibility and the creation of a just society [3]. Since being established by the World Commission on Economic Development in the Brundtland report at 1987 [2, 4], the concept of education for sustainable development has been implemented in several countries, including Japan, Canada, Australia, Malaysia, China, Germany, United Kingdom, Thailand, India and most other countries [5-11].

The concept of education for sustainable development begins with a sustainable development concept that discusses three main topics, namely, environment, social and sustainable economics.
UNESCO recommends that the concept of sustainable development be learned in the learning process with several learning strategies, including experiential learning [12, 13], project based learning [14], inquiry learning [15], story-based learning, value-based education, authentic assessment, problem-based learning, outside-class learning, and problem solving communities [2]. In this study, a learning model was introduced and implemented that had been developed under the name ESD Character Model. The same hope is intended to provide and enhance the character of Indonesia's golden generation.

2. Methods
This research was a qualitative research with aimed to measure and describe the enhancing of character of Indonesian golden generation on the implementation of education for sustainable development through science education. Education for sustainable development was implemented by using a developed learning model namely ESD Character Model. The developed learning model was conducted to 11th grade students in nine high schools in nine provinces in three subjects, are: Biology, Physics and Chemistry. This research was conducted at nine high schools in nine provinces spread in Lampung, Banten, West Kalimantan, Bali, South Sulawesi, West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), Maluku, and West Papua.

3. Result and Discussion
3.1 Implementation of Education for Sustainable Development on Biology Subject
The Biology learning tools based on ESD Character Model syntax was conducted to 11th grade students in 3 schools spread in western, central and eastern regions of Indonesia. In western region, it was chosen Lampung as the pilot project school for implementing education for sustainable development concept. Likewise in the central region South Sulawesi has been selected and in the eastern region West Papua has been selected. In these three schools, ESD Character model has been implemented for several meetings with specific subject matter, System of Reproduction. At the end of the meeting, an instrument was provided in the form of a questionnaire to measure student character. The character assessed in the implementation of education for sustainable development in Biology subjects is communicative, critical attitude, creative, collaboration (4Cs), social care and tolerant. The results of the measurement data are shown in the table 1.

| Character assessed | Category in Each The Chosen School |
|--------------------|----------------------------------|
|                    | School in Lampung (24 students) | School in South Sulawesi (35 students) | School in West Papua (30 students) |
|                    | High | Enough | Low | High | Enough | Low | High | Enough | Low |
| Communicative      | 12   | 9      | 3   | 15   | 13      | 7   | 8    | 14      | 8   |
| Collaboration      | 12   | 10     | 2   | 14   | 15      | 6   | 14   | 12      | 4   |
| Critical Attitude  | 6    | 13     | 5   | 7    | 13      | 15  | 9    | 9       | 12  |
| Creative           | 4    | 8      | 12  | 14   | 10      | 11  | 3    | 21      | 6   |
| Social care        | 8    | 9      | 7   | 13   | 11      | 9   | 10   | 11      | 9   |
| Tolerant           | 15   | 8      | 1   | 15   | 16      | 4   | 15   | 12      | 3   |
| Total              | 45   | 48     | 27  | 63   | 65      | 45  | 51   | 65      | 34  |

Based on table 1, the ability of communicative and collaborative students who are generally can be categorized as high. The students who had collaborative and communicative abilities in the high category were caused by the students involved in organizations at schools. ESD Character Model can stimulate students to interact with the teacher, peers, and society. But, the table inform about students’ critical attitude and creative are still very low. It was because by the time of the learning process students very rarely train students’ critical attitude and creativity. Teachers only though the concept and summative evaluate. Whereas in learning science teachers were required in addition to teach the
concept of science but very need to exercises students critical thinking and attitude, also creativity [16]. Another thing that can be seen from table 2 above is the ability of social care and tolerant of students who are generally can be categorized as high. It was because the model and method of learning that used by teacher in teaching can encourage students to develop their ability of social care and tolerant.

3.2 Implementation of Education for Sustainable Development on Physics Subject
The Physics learning tools based on ESD Character Model syntax was conducted to 11th grade students in 3 schools spread in western, central and eastern regions of Indonesia. In western region, it was chosen Banten as the pilot project school for implementing education for sustainable development concept. Likewise in the central region Bali has been selected and in the eastern region East Nusa Tenggara has been selected. In these three schools, ESD Character model has been implemented for several meetings with specific subject matter, Impact of Global Warming. At the end of the meeting, an instrument was provided in the form of a questionnaire to measure student character. The character assessed in the implementation of education for sustainable development in Physics subjects is communicative, critical attitude, creative, collaboration (4Cs), love peace and environmental care. The results of the measurement data are shown in the following table.

| Character assessed     | Category | School in Banten (35 students) | School in Bali (35 students) | School in East Nusa Tenggara (30 students) |
|------------------------|----------|-------------------------------|-----------------------------|------------------------------------------|
|                        |          | High  | Enough | Low  | High  | Enough | Low  | High  | Enough | Low  |
| Communicative          |          | -     | 8      | 27   | 10    | 11     | 24   | 2     | 17     | 11   |
| Collaboration          | 15       | 12    | 8      | 14   | 11    | 10     | 17   | 7     | 6      |
| Critical Attitude      | -        | 4     | 28     | 2    | 7     | 26     | 1    | 11    | 23     |
| Creative               | 4        | 7     | 24     | 8    | 11    | 16     | 8    | 9     | 13     |
| Love peace             | 15       | 14    | 6      | 11   | 15    | 9      | 12   | 13    | 5      |
| Environmental care     | 25       | 6     | 4      | 17   | 11    | 7      | 11   | 11    | 8      |
| Total                  | 59       | 51    | 97     | 62   | 66    | 92     | 51   | 68    | 66     |

Based on table 2, the ability of communicative and collaborative students who are generally can be categorized as high. The students who had collaborative and communicative abilities in the high category were caused by the students involved in organizations at schools. ESD Character Model can stimulate students to interact with the teacher, peers, and society. But, the table inform about students' critical attitude and creative are still very low. It was because by the time of the learning process students very rarely train students' critical attitude and creativity. Teachers only though the concept and summative evaluate. Whereas in learning science teachers were required in addition to teach the concept of science but very need to exercises students critical thinking and attitude, also creativity [16]. Student’s love peace and environmental shown in high category. Based on the observation that the existence of environmental care and love peace owned by the students actually not only because it is taught through learning in the class but more influenced by the culture and habits that exist in the school environment. In addition, knowledge of environmental awareness and love peace are needed by ensuring sustainability and the peaceful of this world.

3.3 Implementation of Education for Sustainable Development on Chemistry Subject
The Chemistry learning tools based on ESD Character Model syntax was conducted to 11th grade students in 3 schools spread in western, central and eastern regions of Indonesia. In western region, it was chosen West Kalimantan as the pilot project school for implementing education for sustainable development concept. Likewise in the central region West Nusa Tenggara has been selected and in the
eastern region Maluku has been selected. In these three schools, ESD Character model has been implemented for several meetings with specific subject matter, Colloids. At the end of the meeting, an instrument was provided in the form of a questionnaire to measure student character. The character assessed in the implementation of education for sustainable development in Chemistry subjects is communicative, critical attitude, creative, collaboration (4Cs), curiosity and independent. The results of the measurement data are shown in the following table.

| Character assessed | School in West Kalimantan (30 students) | School in West Nusa Tenggara (35 students) | School in Maluku (30 students) |
|--------------------|-----------------------------------------|--------------------------------------------|--------------------------------|
|                    | High | Enough | Low | High | Enough | Low | High | Enough | Low |
| Communicative      | 17   | 7      | 6   | 10   | 11      | 24  | 21   | 8       | 1   |
| Collaboration      | 1    | 11     | 23  | 14   | 11      | 10  | 15   | 12      | 3   |
| Critical Attitude  | 9    | 9      | 12  | 2    | 7       | 26  | 4    | 7       | 19  |
| Creative           | 3    | 21     | 6   | 3    | 9       | 24  | 2    | 7       | 21  |
| Curiosity          | 14   | 14     | 2   | 11   | 14      | 10  | 8    | 20      | 2   |
| Independent        | 16   | 11     | 3   | 11   | 11      | 13  | 17   | 11      | 2   |
| Total              | 60   | 73     | 52  | 51   | 63      | 107 | 67   | 65      | 48  |

Based on table 3, the ability of communicative and collaborative students who are generally can be categorized as high. The students who had collaborative and communicative abilities in the high category were caused by the students involved in organizations at schools. ESD Character Model can stimulate students to interact with the teacher, peers, and society. But, the table inform about students’ critical attitude and creative are still very low. It was because by the time of the learning process students very rarely train students’ critical attitude and creativity. Teachers only though the concept and summative evaluate. Whereas in learning science teachers were required in addition to teach the concept of science but very need to exercises students critical thinking and attitude, also creativity [16]. The student’s curiosity and independent based on the table 2 shown high category. In chemistry lesson plans especially in Colloid matter, there is an experimental topic so that this activity can stimulate students to be more curious about the answer of the case study. This activity also required the students to work together but independently they have to responsible about what they did.

4. Conclusion
It can be concluded that the implementation of ESD character model can enhance several characters of students, especially collaborative, communication, love peace, environmental care and independent. For improvement critical attitude and creativity, ESD character model should be practiced for more time beyond the activity. Besides, it can be inferred that ESD character model can be one of the recommendation model to implement sustainable development concept.

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