The Integrated Model of Sustainability Perspective in Spermatophyta Learning Based on Local Wisdom

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Abstract. In present condition, culture is diminished, the change of social order toward the generation that has no policy and pro-sustainability; as well as the advancement of science and technology are often treated unwisely so as to excite local wisdom. It is therefore necessary to explore intra-curricular local wisdom in schools. This study aims to produce an integration model of sustainability perspectives based on local wisdom on spermatophyta material that is feasible and effective. This research uses define, design and develop stages to an integration model of sustainability perspectives based on local wisdom on spermatophyta material. The resulting product is an integration model of socio-cultural, economic and environmental sustainability perspective and formulated with preventive, preserve and build action on spermatophyta material consisting of identification and classification, metagenesis and the role of spermatophyta for human life. The integration model of sustainability perspective in learning spermatophyta based on local wisdom is considered proven to be effective in raising sustainability’s awareness of high school students.

1. Introduction
Since 2002 United Nations in the general assembly declared Education for Sustainable Development (ESD). The purpose of ESD is to integrate the principles, values and practices of sustainable development into all aspects of education and learning [1]. In the next period Education for Sustainable Development (ESD) is aimed at achieving Sustainable Development Goals (SDGs). SDGs consist of 17 goals and 169 development targets that are scheduled to be achieved in the period 2015 to 2030. Seventeen objectives with 169 targets are expected to address the underdevelopment of countries around the world, both in developed countries (excessive consumption and production, and inequality) and developing countries (poverty, health, education, protection of marine and forest ecosystems, urban areas, sanitation and drinking water availability) [2]. Sustainable development leads us to think collectively about solutions that ensure a future of our choosing that preserves the biological capacity of the planet and to reduce our vulnerability [3].

Sustainable development can be achieved through education, because education is a means to change perceptions, attitudes, and human behavior. All aspects of intelligence in the purpose of education is needed to synergize the economic, socio-cultural, and environmental aspects in processing and utilizing natural resources. Sustainability needs to be applied in formal education learning in schools through means of integration in intracurricular activities [4]. In order to create a life of sustainability that leads to the transformation of social reality directly and in connection with
the environment, it is necessary to take action in the case of "Prevent - Preserve - Build" [5]. Through this action will help to realize the sustainability of nature, human welfare now and future as well as create a sustainable life. The task as a teacher to make the learning process with the context of learning that directs the mindset of learners to form an existing situation so that the situation will remain sustainable in the future. The revised 2013 curriculum formulates that one context in the learning content in the school is Educational for Sustainability Goal (ESG) [6]. Various reports on ESD implementation in Indonesia since 2005 until now show that not many schools are implementing learning with sustainability content provide facts that [4]:

1. Principals and teachers generally do not fully understand ESD, either conceptually, objectives, policies and programs. It has a logical consequence to the application of ESD to the learners.

2. There is no explicit policy on ESD that can be used as a reference for programming and implementation at the education unit level.

3. There is no reference on the implementation of ESD in schools, especially for teachers in implementing learning.

Although since 2010 Balitbang Kemendiknas conceptualizes the education model for sustainable development through intracurricular activities. However, the implementation of ESG is not maximal yet, only one component is implemented, still fragmentary of economic, socio-cultural and environmental components [7, 8]. Similarly, the theoretical study of ESD in formal education learning has been widely written [9, 10, 11], has not explicitly given a concrete example in learning.

Integration of sustainability perspective can be done by it bring issues of environment and development—areas with strong science content [12,13] with exploring local wisdom. In the present condition, the existence of cultural faded, the change of social institution toward the generation that has no policy and pro sustainability and advancement of science and technology is often treated unwisely so that the local wisdom is extinguished. By exploring intracurricularly local wisdom in schools, the present generation has the knowledge and awareness to contribute better to achieve a degree of empowerment in planning, deciding and managing local resources. In some places in Indonesia, there are local values that match the competencies expected of the learners. Aside from being a source of learning from ESD itself, those places of value can be developed into a sustainable way of life that requires transformation and adaptation to the present life, so that future generations will have a modern and sustainable life in accordance with national identity [11]. Added also local wisdom can be used as an academic tool to respond to consumerism culture, forest destruction, lack of water and food supplies, ozone layer depletion, and others. Local wisdom becomes one of the learning sources of social science in schools to build students' ecological intelligence to conserve water, become green consumers, conserve energy in everyday life, recycle, reduce the use of plastics, and more [14]. Local wisdom is any form of knowledge, belief, understanding, or conception and tradition or ethics that direct human behavior in the ecological community [15]. Another sense that local wisdom is a life view, knowledge, and life strategies that are actualized in local community activities to address issues in meeting their needs in all aspects of life, such as religion, belief, science and technology, social organization, economics, language, and arts [16]. One of the local wisdom in Kudus district is a local plant in the mountains of Muria. The mountain Muria is known as a religious tourism place because there is a tomb of sunan Muria, on the other hand the utilization of local plants from the mountains of Muria for sale and consumed as souvenirs finished pilgrimage [17,18]. Knowledge of local wisdom in the use of local plants in the mountains of Muria should be given to students to participate to help sustainability of local plants in the mountains of Muria through learning spermatophyta. Based on the above background, this research develops a sustainability perspective integration model on spermatophyta material in High School X class that is effective to increase awareness about sustainability.

2. Experimental Method
The model of integration of sustainability perspective in spermatophyta learning is generated by define, design and develop [19]. In the define stage are: (1) analysis of potential and problem sustainability in the mountains of Muria, kudus district (2) literature study and field research. The
survey was conducted on 40 high school students (twenty four females and sixteen males) using a questionnaire for sustainability awareness, observations were made on local wisdom in the mountains of Muria. The design stage is carried out to: (1) design an integration perspective model of sustainability in intracurricular activities in the high schools, continued (2) create an initial product. The development stage includes: (1) product feasibility test, (2) product revision done in accordance with expert advice and assessment, (3) field test. The integration perspective model of sustainability is tested by Focus Group Discussions (FGD) using validation questionnaires related to syllabus, lesson plan, teaching materials, media, and evaluation tools. Field tests were conducted to analyze model effectiveness at one high school by measuring peningkatan dan perbedaan skor sustainability awareness before and after subsequent learning.

3. Result and Discussion
This mountainous forest area of Muria has natural resources that can meet the needs of surrounding communities. People believe that some plants can be used as food and medicine to cure diseases [17]. The plants include parijoto (Medinella speciosa), ganyong (Canna edulis), jeruk pamelo (Citrus maxima), pisang byar (Musa sp), delima (Punica granatum), labu siyam (Sechiun edule), kopi (Coffea canephora), talas (Calocasia esculentum), and pinus (Pinus merkusii). Local wisdom is useful in maintaining and processing natural resources around. [18].

Local wisdom of Muria Mountain in the form of local plant biocology of Muria can be applied in high school material. One of the materials that should be mastered by high school students of class X is spermatophyta. The main study of this material is the general characteristics of seed plants, the classification of seed plants, the way of reproduction and the role of seed plants in life. The material of spermatophyta is one of the most difficult material to understand because of its vast scope and many examples of spermatophyta, so to classify it is not easy. The material of spermatophyta has so many various characteristics that to study spermatophyta is not enough only with theoretical explanation without supported by proper learning so that it takes sample of contextual problem close to student life. The learning result of spermatophyta based on local wisdom in the form of plant biocology in the mountains of Muria is expected to give students cognitive, psychomotor and affective competence comprehensively and simultaneously about environment, socio-culture and economy. This is in accordance with 3 perspectives in Education for Sustainable Development (ESD) that is environmental, economic and socio-cultural.

The student's sustainability awareness based on questionnaire got average score 55.75 with low category, even 87.5% student not yet understand about understanding of sustainability, sustainable development, education for sustainable development and sustainable development goals. Students claimed to have never been taught spermatophyta material with sustainability content and little familiar with local wisdom in the mountains of Muria.

In the 2013 curriculum (revised edition), the time allocation of spermatophyta material is 6x45 minutes. Spermatophyta, bryophyta and pteridophyta are one of the Plantae materials with an allocation of 12 hours of study. Basic competencies containing spermatophyta materials are basic competencies: (1) Apply the classification principle to classify plants into divisio based on observations and metagenesis of plants and relate their role in the survival of life on earth; and (2) Presents data on observations and phenetic and phylogenetic analyses of plants as well as the role of plants in the survival of the earth [20].

The results of field studies and literature studies, used as a reference for making a draft model integration perspective of sustainable development. In general the model can be seen in Figure 1, hereinafter translated specifically in spermatophyta learning. This model is developed from the theoretical definition of Birdsall [21] on sustainability by incorporating preserve, prevent and build actions formulated by Grigorov and Fleuri [5] in the context of social transformation through local wisdom-based learning. Figure 1 illustrates learning with the context of the local wisdom use of a region at present to take action, attitudes and knowledge related to preserve, prevent and build covering the economic, socio-cultural and environmental aspects of a particular learning material so that what has existed since the past will continue into the future (sustainability).
Figure 1. The general model of integration of sustainability perspectives in learning

Furthermore the model is translated into the integration of basic competencies and indicators of competency achievement from the curriculum 2013 (revised edition), is shown in Table 1.

**Table 1.** Model integration of sustainability perspective on basic competencies and Indicators of achievement basic competence of spermatophyta

| Basic competencies | Indicators of Achieving Basic Competencies | Integration of sustainability perspective | Learning time allocation process : 6x45 ' |
|-------------------|-------------------------------------------|------------------------------------------|------------------------------------------|
| 1. Applying the classification principle to classify plants into division based on plant observation and metagenesis as well as linking its role in the survival of life on earth. | 1.1 Identify common characteristics of spermatophyta using local wisdom of plants in the mountains of Muria. | Environmental and socio-cultural | 1. 1st meeting: 2x45' to reach indicator 1.1; 1.2; 1.3 and 2.1
a. Learning model: discovery learning
b. Learning media: videos about the biodiversity of local plants in the mountains of Muria, and the original media of local plants of the mountains of Muria
c. Teaching materials: student worksheets and books
2. 2nd meeting: 1x 45' to reach indicators 1.5 and 2.2
a. Learning model: project based learning
b. Learning media: videos of local |
Table 1. Cont.

|   |   |   |
|---|---|---|
| 1.3 | Classify based on the characteristics of spermatophyta using local wisdom of plants in the mountains of Muria. | Environmental and socio-cultural |
| 1.4 | Analyzing the process of metagenesis angiospermae and gymnospermae as local wisdom in the mountains of Muria. | Environmental and socio-cultural |
| 1.5 | Analyze the role of spermatophyta as a local wisdom in the mountains of Muria. | Economic, socio-cultural |
| 2. | Presents data of observations and phenetic and phylogenetic analyzes of plants and the role of plants in the survival of the earth. |   |
| 2.1 | Creating a phenetic and phylogenetic relationship chart based on observed data of spermatophyta plants. | Environmental and socio-cultural |
| 2.2 | Making innovative spermatophyta plant products from the mountains of Muria belonging to the plant is accompanied by conservation efforts by planting in the schoolyard | Economics and environment |
| 3. | 3rd meeting: 2x 45' to reach indicator 1.4 a. Learning model: problem based learning b. Media of learning: original media of local plants mountains Muria various forms of growth and development phase c. Teaching materials: student worksheets and books |   |
| 4. | 4th meeting: 1x 45' to reach indicators 1.5 and 2.2 a. Learning model: project based |   |
Table 1. Cont.

|                        | b. Learning media: products made by students | c. Teaching materials: student worksheets |
|------------------------|---------------------------------------------|----------------------------------------|

This meeting continued from the project based learning model at the 2nd meeting, this stage conducted a product evaluation and planting local plants mountains of Muria in the schoolyard.

Table 1 represents the learning of spermatophyta material done to prevent socio-cultural faded in the form of local wisdom of the community in the utilization of plants in the mountains of Muria. By engaging in environmental and community issues in the mountains of Muria, students are increasingly aware and conscious to contribute better to local wisdom, then there is an effort to maintain through activities or actions by utilizing in learning spermatophyta material that is knowing the characteristics, classify, analyze metagenesis and develop the role of local plants in the mountains Muria by making product innovation higher selling value, but still pay attention to the preservation of local plants mountains Muria by planting typical plants Muria in the school yard. When it is attributed with the objectives and targets of sustainable development goals (SDGs) [2], this is consistent with the 4th objective, namely Quality Education - Ensure inclusive and equitable quality education and promoting lifelong learning opportunities for all; 12th objective of Responsible Consumption and Production - Ensures sustainable consumption and production patterns; and the 15th objective of Life on Land - Protect, restore and promote sustainability of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

This integration model was further tested by Focus Group Discussion but there are suggestions for improvement that is at the meeting of the 3rd and 4th be one only to 3x45 'because it is not enough time presentation the product proceeds with the local planting of the Muria mountains in the schoolyard within 1x45 minutes. This improvement leads to the understanding of spermatophyta sustainability based on local wisdom more comprehensively ie understanding of spermatophyta metagenesis becomes more real as it is practiced with planting plants, as well as conditionize the students' understanding that the utilization of the plant must be accompanied by its preservation. Integration model is further realized in the learning process with learning tools equipped with syllabus, learning process plan, media, teaching materials and evaluation tools that are also tested feasibility by experts.

To see the effectiveness of sustainability perspective integration model, sustainability awareness measurement of students before and after learning with the results is shown in Table 2.

| Table 2. Pretest and posttest results of sustainability awareness |
|---------------------------------------------------------------|
|                  | Means score | N gain | Category | p     |
| Pretest          | 6.54        | 0.83   | high     | 0.003 |
| Posttest         | 13.57       |        |          |       |

Table 2 shows that improving perceptions of student’s sustainability awareness after material learning are integrated with sustainability perspectives with high category and proven by t dependent test show
significant differences. This is due to the learning of spermatophyta material done using the context of local wisdom in the mountains of Muria to recognize and awaken to students the value of sustainability through integration of sustainability perspectives that are socio-cultural, economic and environmental; also implement a preventive, preserve and build action framework simultaneously with exploring activities ranging from identifying, classifying, analyzing metagenesis of typical Muria mountainous plants directly, empowering typical Muria crops into innovative products to planting local seedlings of mountains of Muria in school environments as conservation efforts. This has succeeded in encouraging students to engage more actively in assimilating, accommodating, organizing and constructing concepts in mind. It is known that various factors such as the nature of the stimulus, the background of individual experience, motivation and so on play a role in determining one's reaction to environmental and social stimuli [22]. Targeted student activity is an extrinsic factor affecting students' interests, attitudes and motivations [23,24].

When analyzed based on the aspect of sustainability awareness there is a difference in the improvement of each aspect, seen in Table 3.

Table 3. Increased perception of sustainability awareness based on aspects

| Sustainability awareness aspect          | N gain |
|-----------------------------------------|--------|
| A. Sustainability knowledge awareness   | 0.80   |
| B. Attitude awareness                   | 0.83   |
| C. Practice awareness                   | 0.80   |

Table 3 shows that the improvement of each aspect is all in the high category, this is because if you already know and understand something well, it will create a caring attitude then will be able to take appropriate action. This is in accordance with the results of research that the program is done by challenging, that is the complexity of the environment can improve the competence not only knowledge but activate interdisciplinary thinking, skills and awareness about ESD [25]. The experience possessed will play a role in shaping the cognition and feelings of a person against certain attitudinal objects that can be used to know the tendencies of one's behavior [26, 27, 28]. Children preference for natural environment setting through their Local Wisdom, which can be used to enhance environmental awareness [29]. It is also supported by research in India that the application of learning uses local potential and long-term conservation efforts on student attitudes toward local biodiversity and shapes attitudes for the future [30].

4. Conclusion

The sustainability perspective integration model has been successfully developed based on the general representation of sustainability component interaction (environmental, economic, socio-cultural / society) on specific learning materials framed by preserve-build action framework and by using the context of local wisdom. In particular, the model of sustainability perspective integration on spermatophyta based materials learning of local wisdom of Muria mountain plant has proven effective in increasing awareness of sustainability of students, whether it concerns aspects of sustainability knowledge awareness, attitude awareness and practice awareness. This happens because in learning it appears that students are involved more actively in assimilating, accommodating, organizing and constructing both concept of knowledge and attitude / value system in their mind.

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