

PAPER • OPEN ACCESS

The compost tea on hydroponics system used to increase understanding of Sustainable Development for high school student in Adiwiyata program

To cite this article: E Hartadiyati *et al* 2020 *J. Phys.: Conf. Ser.* **1567** 022060

View the [article online](#) for updates and enhancements.

You may also like

- [Promoting environmental literacy through a green project: a case study at adiwiyata school in Banda Aceh City](#)
P A Kamil, E Putri, S Ridha et al.
- [A-G-I-L scheme as social system to build characters caring for the environment through the Adiwiyata program](#)
S Megawati, F Niswah, M A Mahdiannur et al.
- [Adiwiyata School: An environmental care program as an effort to develop Indonesian students' ecological literacy](#)
R Febriani, U Fariyah and N E A Nasution



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

The compost tea on hydroponics system used to increase understanding of Sustainable Development for high school student in Adiwiyata program

E Hartadiyati^{1,*}, Wiyanto², A Rusilowati²

¹ Biology Education Department, Universitas PGRI Semarang, Semarang, Indonesia

² Science Education Department, Program Pasca Sarjana, Universitas Negeri Semarang, Semarang, Indonesia

*Corresponding author: hartadiyati@gmail.com

Abstract. Compost tea is made from compost extracts that contain nutrients needed for plant growth and development. Hydroponics is a planting system that depends on the availability of organic nutrients in the planting medium so that it produces plants that are ready for consumption that are safe and nutritious. This is the basis for providing an understanding of Sustainable Development for high school students in the Adiwiyata program. Adiwiyata is a program that aims to create good conditions for schools to become a place for learning and awareness of school residents (teachers, students, and other workers), to encourage efforts to save the environment and Sustainable Development. The purpose of this study is to increase the understanding of Sustainable Development in high school students in the Adiwiyata program. This study uses one high schools in the Adiwiyata program. Before and after the activity of literacy a hydroponic system using compost tea for safe and nutritious food security and healthy environment, then students were given questions about Sustainable Development. The results showed an increase in understanding of Sustainable Development.

1. Introduction

The Adiwiyata program can create a school institution that cares and is cultured in the environment based on the norm of togetherness, openness, honesty, justice, environmental sustainability and natural resources. It is hoped that through this program in the future the school community will be able to take responsibility in efforts to save the environment and sustainable development [1]. In the implementation in schools, there are many activities carried out such as (1) Development of environmentally-friendly and cultured school policies, (2) Development of environment-based curriculum, (3) Development of participatory-based environmental activities, and (4) Development and management of supporting facilities for environment-friendly schools such as : saving energy, using alternative energy, saving water, managing waste and using organic fertilizer [2].

Sustainable Development, in general, is a human effort to improve the quality of life while still trying not to exceed the ecosystem that supports its life. Furthermore in the Sustainable Development Goals (SDGs) designed by the United Nations that all countries in the world must end poverty, implement strategies that can improve health and education, reduce inequality, and spur economic growth, all while addressing climate change and working to conserve the oceans and Forest [3].

An understanding of Sustainable Development must be shared by all ages and groups of people. The goal of the declaration was to promote sustainability at all levels of education, including high



school students. However, there is no research that reveals high school students' understanding of Sustainable Development in students in schools with the Adiwiyata program.[4-8]. For this reason, it is necessary to provide an understanding of sustainability mindset to high school students in the Adiwiyata program. One way to do this research is to use literacy about Compost tea to grow buttehead lectures with a hydroponic system.

Compost tea is made from compost extracts that contain nutrients needed for plant growth and development. Hydroponics is a planting system that depends on the availability of organic nutrients in the planting medium so that it produces plants that are ready for consumption that are safe and nutritious. The availability of organic nutrients fulfilled by compos tea. This is the basis for providing an understanding of sustainable development for high school students in the Adiwiyata program.

The method of making compost tea for planting butterhead lattuce on the hydroponic system is as follows. Materials: Water, pH meter, thermometer, air pump, compost, additional food (organic molasses), brew tank or gallon with 15 to 20 L capacity, 1000 micron basket, or two layers of 800 micron mesh bag, EC meter, stirrer, waterproof tape, air stone, 5 cm net pots, tray, rockwool, styrofoam. Experimental preparation: (1) Prepare the tools and materials; (2) Seeding the lettuce seeds in rockwool. Cut the rockwool into small cubes with the length of each side is 2 cm, give the small holes for seeds in rockwool using a toothpick. And then place the seed into the holes. Put them on the seeding tray after giving it water; (3) The seeding proceess needs for about 2 weeks. Preparing the hydroponic's system: (1) Preparing the tools and materials,; (2) Cut the styrofoam with distance between netpots are 20 cm. Compost tea brewing: (1) On the bottom of the gallon, place the air stone or bubblers attached to the air pump; (2) Fill the brew tank/gallon with water, then turn the air pump on for about 10 until 20 minutes before adding the compost; (3) Add compost into 1000 micron basket, or in a 800 micron mesh bag; (4) Add food additives (organic molasses), after 15 minutes of brew time. This will allow the compost microbe to disperse throughout the tea; (5) Brew until 24 – 48 hours, or four days, or 2-3 days. Experimental execution: (1) Selecting butterhead lettuce plants that have emerged from the nursery; (2) Place the seeds along with rockwool into the netpot; (3) Place the netpot into styrofoam that has been prepared and in accordance with a predetermined design; (4) Pour the compost tea into the hydroponic system within one hour after completion of brewing. Some stages of planting butterhead lettuce using compost tea in a hydroponic system can be seen in Figure 1.

The purpose of this study is how to use compost tea to increase the understanding of Sustainable Development in high school students in the Adiwiyata program. It is expected that students will not only know about environmental awareness but comprehensively have a mindset that there is social awareness in carrying out an activity, the formation of economic empowerment from the process and the preservation of the environment as an impact.

2. Method

A total of 15 students in one of the Adiwiyata program schools in the city of Semarang were given literacy activities about making compost tea for planting butterhead lettuce plants with a hydroponic system. In the literacy activity there was also a discussion about Sustainable Development. Before and after the literacy activity, a test on Sustainable Development is conducted. The test given is in the form of an open ended test consisting of the understanding of sustainable development, cases in the daily lives of students relating to Sustainable Development and solving problems in the school environment. Students use the definition of Sustainable Development which includes economic, social- cultural and environmental aspects, namely development in economic and social fields but do not damage the environment so that life will take place well in the present and in future generations. The pretest and posttest results data were analyzed using t-dependent test to find out the significance [9], and then also analyzed how to increase students' understanding of Sustainable Development using the N gain test [10].



Figure 1. Compost tea for growing a buttehead lecture using a hydroponic system

3. Result and Discussion

Data and analysis students' understanding of Sustainable Development is seen in Table 1.

Table 1. Students' understanding of Sustainable Development

Mean Score		N gain	Category	<i>p</i>
Pretest	Posttest			
2.66	11.29	0.82	high	0.000

Table 1 seen to increase students' understanding of Sustainable Development (seen from the pretest and posttest) in the high category, and the t test analysis informs that the pretest and posttest differ significantly ($p < 0.05$).

The achievement of these results is caused in the compost tea literacy activities in the hydroponic system there was a discussion that could lead students to understand Sustainable Development, as follows:

1. Discussed from the general understanding of sustainable development, namely creating and preparing a better quality of life for the current generation and future generations based on human rights that contain 3 aspects, namely economic, socio-cultural and environmental. Economically the use of compost tea can be done at a low cost, can produce various types of vegetables and fruit, consumed alone or sold so as to increase income, from the social aspect can support health because it does not use chemicals that can interfere with health, and from environmental aspects, namely the use compost tea does not pollute the land or water, even is the realization of sustainable agriculture or cultivation. This is in accordance with the concept of sustainable development that there are 3 economic, socio-cultural and environmental aspects that are interconnected to show the sustainability [3]. A similar way to do education is to provide an understanding of Sustainable Development by analyzing and evaluating using architecture and its products as a concrete material for sustainability education [11], can also use species identification and biodiversity [12].
2. Discussed from the perspective of Sustainable Development Goals (SDGs), which are 17 objectives. In the discussion students find the points as follows:
 - a. Compost tea in a hydroponic system can target the first goal. Is to eradicate poverty in any form by increasing income for the population. Hydroponic cultivation can be done easily by anyone and anywhere, including high school students. The use of easy and inexpensive compost tea will increase people's income. As was done in Nigeria that entrepreneurship education is implemented at all levels of education to enhance Sustainable Development, namely reducing poverty [13].
 - b. Compost tea in the hydroponic system can target the second goal is to eradicate hunger which includes improving nutrition and nutrition; sustainable agricultural cultivation and food security. Hydroponic systems can be carried out by all regions based on geography, both in villages and cities and can grow various types of plants such as fruits and vegetables so that they will support improved nutrition and nutrition as well as food security. This is appropriate in Peru that the hydroponic system is used to reduce malnutrition and poverty [14].
 - c. The use of compost tea will lead to the cultivation of a sustainable hydroponic system, with the following explanation: Nutrients are always available in compost tea and the availability of nutrients for plants is always fulfilled by the role of microorganisms, namely decomposing complex molecules into simple molecules, then becoming nutrients available to plants . Sustainable hydroponics is almost the same as compost tea studies on aquaponics as sustainable practical [15, 16].
 - d. Compost tea in the hydroponic system is in accordance with the third goal of ensuring health for the community because the fertilizer used is organic fertilizer rather than chemical fertilizer. Chemical fertilizers can accumulate in vegetables and fruit, if consumed in excess will cause diseases for those who consume them.
 - e. Compost tea in the hydroponic system is in accordance with the sixth goal, which is to guarantee the availability of sustainable clean water for everyone. This is because compost tea is an organic material so it is not an ingredient that can pollute the environment without water exception. This is consistent with the results of the study that known compost tea does not cause pollution but can inhibit the transmission of diseases transmitted through the soil [17] .

4. Conclusion

The use of compost tea in the hydroponic system caused a significant increase ($p < 0.05$) in students' understanding of Sustainable Development quantitatively, amounting to 0.82 with a high category. Students' understanding is not only about environmental awareness and sustainability, but also comprehensively understanding sustainable development.

References

- [1] Keputusan No.03/MenLH/02/2010, No.01/II/KB/2010 tanggal 1 Februari 2010 tentang Pendidikan Lingkungan Hidup melalui Program Adiwiyata.
- [2] Peraturan Menteri Lingkungan Hidup Republik Indonesia no. 5 tahun 2013 tentang Pedoman Pelaksanaan Program Adiwiyata
- [3] UNESCO Education Sector 2017 *Educ. Sustain. Dev.* (Paris: United Nations Educational)
- [4] Eni P, Udik Budi W 2019 *Int. Conf. Meaningful Educ. KnE Soc. Sci.* 2019
- [5] Adela D, Sukarno, Indriayu M 2018 *Adv. Soc. Sci. Educ. Humanit. Res.* 262
- [6] Tanu D, & Parker, L 2018 *Indones. Malay World* 1–22
- [7] Anggraini W, Karyanto P, Sarwanto, & Prihantomo 2019 *J. Phys.: Conf. Ser.*, **1233** 012084
- [8] Desfandi M, Maryani E, Disman 2019 *Sumat. J. Disaster Geogr. Geogr. Educ.* **3** 2
- [9] Kim T K 2015 *Korean J. Anesthesiol.* **68** 6
- [10] Hake R.R. 1998 *Am. J. Phys.* **66** 66
- [11] Tascı B G 2015 *Procedia - Soc. Behav. Sci.* 186
- [12] Palmberg, I., Hofman-Bergholm, M., Jeronen, E., & Yli-Panula, E. 2017 *Educ. Sci.* **7** 3
- [13] Arogundade, Babatope Bukola. 2011 *J. Emerg. Trends Educ. Res. Policy Stud.* **2** 1
- [14] Orsini F, Morbello M, Fecondini M and Gianquinto G 2010 *Octa Hortic.* 881
- [15] Van Os E A 2001 *Octa Hortic.* 548
- [16] Mintz, Amanda 2019 *Integrating Sustainable Practices: Compost Tea As A Nutrient Supplement For Aquaponic Plant Production-* A Thesis The Evergreen State College.
- [17] St. Martin C C G, & Brathwaite R A I 2012 *Biol. Agric. Hortic.* **28** 1