Research Article

Students’ scientific attitude during the Implementation of innovative green garden-based education

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INTRODUCTION

Science education develops science knowledge; hence science processes skills and scientific attitudes among the students. The development of the students’ scientific attitude is one of the most important learning outcomes of science education. Also, the 2013 Indonesia curriculum emphasizes the importance of developing students’ scientific attitudes including curiosity, honesty, logic, critical thinking, discipline, and responsibility. Many attempts over the last five decades to measure students’ attitudes towards school science, scientific attitudes should be a major concern of science teachers. The entire personality of student is influenced by the nature of the attitudes (Balaji, 2017; Kennedy, Quinn, Taylor, Quinn, & Taylor, 2016). Scientific attitude is characteristic of a scientist. Scientific attitude is explained as the mental state, representing a tendency to react favorably or unfavorable toward designated class of stimuli according to the
ethics of science (Pitafi, Pur, & Farooq, 2012), Revati & Meera (2017) define scientific attitude as solving a problem objectively, without bias using logical thinking. Korur (2016) measured the scientific attitudes in relation with curiosity, critical thinking, proof dependent, persistency, co-operation, objectivism, and acceptance of uncertainty. Ural & Gençodan (2020) emphasized three basic components of scientific attitudes including belief, feeling, and action. The belief and feeling towards science leads someone to act. To conclude, scientific attitude can be explained as complex values and norms which is internalized by the man of science. Some of the elements of scientific attitude are open-mindedness, rationality, curiosity, critical thinking, cooperation, honesty, and persistency (Lacap, 2015; Pitafi et al., 2012). The importance of attitude may be inferred from the fact that attitudes determine behavior (Pitafi, et al., 2012). Scientific attitude can help the students solve problems objectively (Kaur, 2013). Lacap (2015) concludes that there is a significant relationship between academic performance and scientific attitudes. Scientific attitudes have an important role in developing scientific literacy (Korur, 2016).

On the contrary, based on the PISA (Program for International Student Assessment) result, Indonesia was fairied poorly in science compared to all the other countries in the world. Indonesia was ranked 63rd from the 65 countries reviewed in 2012 and 62nd from 70 countries in 2015. The results of surveys, interviews, and observations toward science teachers and students in the junior high school 8 Salatiga as one of the public school in Indonesia that promote “adiwiyata” or green school program showed that the scientific attitude students had not developed optimally. The curiosity and critical attitude of students towards natural phenomena around them is still low. This is proven by the attitude of students who rarely ask question from the teacher during science learning. Students tend to be passive and wait for the teacher's command to do something. Students do not have the initiative to find out information through books.

According to the teacher’s explanation the students' scientific attitudes are still low because of: 1) the lack of learning media that support the development of scientific attitudes; 2) the limited opportunities for teachers to develop the learning media; 3) the lack of assistance to teachers regarding the development of learning media; and, 4) the lack of assistance to students in science learning. Actually, some teachers already have applied various science learning models in the class, such as direct instruction and some of cooperative learning models. However, the teachers stated that these models have not been able to increase students’ awareness to be disciplined, critical, responsible, and curious because of the limitation of learning media. Consequently, it is necessary to provide a learning media that can enhance the students’ scientific attitude. As one of the alternatives, teachers can implement the innovative green garden-based education during the science learning process (Macquarrie, 2016; Wolsey & Lapp, 2014).

The innovative green garden-based education can become an instructional strategy that utilizes a garden as an instructional resource, a teaching tool. It has components that are close to the lives of students. If students are familiar with the components that they learn, it is expected that students will more easily and actively manage the gardens in the school. Much attention has recently been paid to children’s learning outside the classroom (Harris, 2015; Harris & Bilton, 2018; Prince, 2018). Outdoor learning is not a new perspective; there have been many scholars who have endorsed the benefits of children having experiences of this natural learning environment (Davies & Hamilton, 2016). Based on Alderson, Hempel, & Olsson (2015) school garden has common focus on growing plants in a few pots or in schoolyard. Gardening programs are flexible in all shapes and sizes fit with the needs and resources of every school. In this research, the innovative green garden-based education adopted by the school garden initiated by Food and Agriculture Organization of The United Nations (FAO, 2009).

The innovative green garden uses soil and non-soil planting media (rock wool, perlite, or coco peat). The use of different planting media will lead to variations in natural processes because the planting media material has different chemical structures, characters and types of microorganisms (Best, et al., 2014; Grunert, et al., 2016). The plants chosen are those that are easy to grow, have a good taste (if for consumption), have attractive colors and shapes, and are suitable for the weather and geographical conditions in Salatiga. Plants for consumption must support students’ nutrition, for example vegetables and fruit. Student involvement in school garden activities can increase students’ willingness to taste vegetables, increase students’ appreciation of vegetable flavor (Morgan et al., 2017; Tmador, Farmer, Maximova, Willows, & Kootenay, 2015), increase the variety of vegetables consumed by students (Leuven, Rutenfrans, Dolfing, & Leuven, 2018), and increase the amount of vegetables consumed (Kim & Park, 2020; Soga, Gaston, & Yamaura, 2016).

The green garden-based education model emphasizes the active participation of students in planning, manufacturing, and maintaining gardens. The garden contains various components of living things (plants and animals) and nonliving-things (soil, organic matter, and water). All of these components interact to form natural processes such as the food chain, and the growth, development, and decomposition of living things. This phenomenon can be observed directly by students. Through observing these natural phenomena, students can learn science concepts in a real way. The green garden-based education criteria as contextual science learning
media are described as follows: It has biotic components (plants and animals) and abiotic (water, soil planting media, non-soil planting media). Learning in the school garden can improve students’ understanding of plant identification (Passy, 2012; Somerset & Markwell, 2017).

Learning throughout green garden-based education component, students can recognize various kinds of living things, environmental components, and interactions and natural processes that occur. Hands-on learning that is conducted in garden-based learning process has been shown to be an important component in involving student in experiential learning is also found to help promote higher-level learning (Bento & Dias, 2017). Also, the participation of the students when they are learning science through innovative green garden is expected to develop students’ scientific attitude. The school garden can be an effective teaching tool that promotes hands-on activities. It provides dynamic environments that help the students to observe, discover, investigate, and learn. The students become an active participants learning science in the real-life experiences. They gain the knowledge of plant and animal life cycles, an appreciation for ecosystems, food origins and nutrition (Alderson et al., 2015).

Many studies on scientific attitude have been done but study about the scientific attitude of students during the implementation of innovative green garden- based education in Indonesia has not been explained much. In general, the science learning process is conducted in the classroom. However, many benefits can be reached when the student can experience their knowledge directly in the environment, for example, if they study science through innovative green garden. The research aimed to address the students’ scientific attitude toward the implementation of innovative green garden-based education at junior high school 8 Salatiga also the teachers’ and students’ perceptions about the implementation of innovative green garden-based education at junior high school 8 Salatiga.

METHOD

This is a case study that determined the student’s scientific attitudes toward the implementation of innovative green garden-based education and the perception of teachers and students toward the implementation of innovative green garden-based education. The study was conducted from June 2018 - December 2018. The sample of this study was targeted and convenient. The respondents consisted of the 33 students that join innovative green garden-based education course as extracurricular activity in the junior high school 8 Salatiga and four teachers who teach Science. The school is one of ‘adiwiyata’ school that promote the importance of green school program. The head school and the teachers gave clearance to conduct this research. The respondents were not subjected to protect their identity.

The mixed methods design was used in this study. Quantitative data was gathered through scientific attitude questionnaire that was adopted from Kurur, (2016) and Pitafi et al., (2012). The questionnaire consists of the scientific attitude elements which are: curiosity, dependent on proofs (rationality, open mindedness, critical thinking), cooperation, honesty, and persistency. The reliability of the questionnaire (Cronbach Alpha) was 0.87, which is considered as higher for studies in education and social sciences (Table 1). Final version of scale consisted of 20 positives and 8 negative items out of 28 total using Likert scale with 1-5 category with 5 as strongly agree, and 1 as strongly disagree for positive items. The negative statements are scored inversely. The mean score of each questionnaire item was calculated. Each element of scientific attitude was categorized based on Pitafi et al. (2012) presentation. The element with mean score below 3.0 means negative attitude, 3.0 as neutral attitude, 3.1 to 3.5 as slightly positive attitude, 3.6 to 4.5 as moderately positive and 4.6 to 5.0 as highly positive attitude. The questionnaire was distributed after the innovative green garden-based education course had been finished.

| Elements          | Item (s) retains | N of items | Reliability (Cronbach’s Alpha) | Internal Consistency |
|-------------------|-----------------|------------|-------------------------------|---------------------|
| Curiosity         | Positive 8, 10, 27 Negative 20 | 28 | 0.87 | Good |
| Dependent of proofs | Rationality 5, 7, 15, 17, 26 | 11 | | |
|                   | Open mindedness 4, 13, 21, 25 | 28 | | |
|                   | Critical thinking 2, 6, 16 | 23,18 | | |
| Cooperation       | 14 | 24 | | |
| Honesty           | 9, 19 | 12, 22 | | |
| Persistency       | 1, 3 | | | |

Priyayi et al (Students’ scientific attitude toward the implementation …)
The qualitative data of students’ scientific attitudes and the perceptions was collected by interviewing the students and the teachers during and after the implementation of innovative green garden-based education. The respondents of the interview were seven students that were selected randomly and four science teachers. The interview was conducted with each person using semi-structured interview models. The researcher asked about 5 main questions (Table 2) toward the implementation of innovative green garden-based education. The questions were developed based on the information that the researcher needed.

![Table 2. The main interview questions](image)

| No. | The main questions                                                                 |
|-----|-----------------------------------------------------------------------------------|
| 1.  | What do you feel during the implementation of green garden-based education?       |
| 2.  | What are the strengths of the implementation of green garden-based education?     |
| 3.  | What are the weaknesses of the implementation of green garden-based education?    |
| 4.  | Please explain your experiences what you have learned during the implementation of green garden-based education? |
| 5.  | What do you want to learn during the implementation of green garden-based education? |
| 6.  | What are your suggestions for the next program related with the implementation of green garden-based education? |

**RESULTS AND DISCUSSION**

The school garden movement has grown as tools for helping teacher teach hands-on experience and improve healthy eating behaviors. It share philosophies of learning with experiential learning, environmental awareness, ecological literacy, and agricultural literacy (Wells et al., 2015). It provides dynamic environments that help the students to observe, discover, investigate, and learn. These practically activities can lead to the development of students scientific attitude (Balaji, 2017; Erdogan, 2017). Many studies on scientific attitude have been done but study about the scientific attitude of student during the implementation of innovative green garden-based education in Indonesia has not been explained much. This study focused on the students’ scientific attitude and the perceptions of student and teacher toward the implementation on green garden-based education that implement in the junior high school 8 Salatiga. The data was gathered through questionnaire and interview methods.

**The students’ scientific attitude toward the implementation of green garden based-education**

![Figure 1. The mean score of each student’s scientific attitude elements](image)

In general, Figure 1 shows that there is positive student’s scientific attitude toward the implementation of innovative green garden-based education. It can be concluded from the mean score of all elements is more than 3.1. The highly positive attitude can be shown in curiosity and cooperation elements, and moderately positive in open-mindedness, rationality, critical thinking, honesty and persitency. The highest mean score is
curiosity and the lowest mean score is persistency attitude. The former research by Greer, Rainville, Knausenberger, & Sandolo (2019) also concluded that garden based-learning can promote positive attitudes toward learning. Based on the analysis of each item statement related to students’ scientific elements in Table 3, it can be noted that all items included positive attitude starting from slightly positive to highly positive attitude with 3.2 as the lowest mean score and 4.7 as the highest mean score. Both of quantitative and qualitative data presented consistently that the respondents agree that the implementation of innovative green garden-based education has many advantages for learning science. The activities can lead to positive students’ scientific attitude.

| Element | Description | Mean Score |
|---------|-------------|------------|
| Curiosity | Development when students have to observe the environment directly. They wanted to know what the cause of a phenomenon is. Various questions arose and they tried to find the answers through asking the teacher or looking in books or other resources. Curiosity is considered to stimulate exploratory behavior. It leads to develop sensory data input. A curious person asks questions, read information, and carries out investigation (Pitafi et al., 2012). | 4.7 |
| Cooperation | Students realized that they have responsibility to reach their goal together. School gardening builds the social well-being impacts. The personal well-being impact such as enjoyment and feeling of achievement, satisfaction, and pride from nurturing the plants, observing them grow and harvested the crops. These initiate the sense of connection to nature, empathy, and care in terms of how they interact with people. Gardening can eliminate some of the social boundaries (Mcclintic & Petty, 2015; Ohly et al., 2016). The student participation in garden program helps students refine teamwork skills, and self-understanding. It develops the ability to make decisions and communicate. School garden also provides possibilities for building up social competences, improve the relationships and communication among the students and also with the teachers (Dawson, Richards, Collins, Reeder, & Gray, 2013; Slabe, 2017) | 4.7 |

The scientific attitude elements that include in moderately positive attitude are open-mindedness, rationality, critical thinking, honesty and persistency. All of these attitudes can be formed through the activities that were conducted based on science methods. The students with open-mindedness attitude willing to change his mind based on reliable evidence and the respects another’s point of view. The students built trust from the results of the researches that follow scientific processes. They also considered the different idea if they get the evidence. Learning through innovative green garden-based education can develop rationality and critical thinking. These attitude guides the scientists’ behavior throughout the investigation about where is the source of his knowledge come. The student habit of looking for natural causes and for natural events is developed. The honesty attitude is concerned with the conscious act of truthfully reporting observations. Then, they were enabled to discover the concept and solve the problems and obstacles that they faced during the innovative green garden-based education course. Students participated to reflect the knowledge and experiences in a daily journal. They gained knowledge and empowered to try a new behavior (Greer et al., 2019; Pitafi & Farooq, 2012). The implementation of innovative green garden-based education is a great tool to enhance understanding of sustainable development. Growing the plants enables the development of a deeper knowledge about food production and the importance of sustainable management (Cutler-mackenzie & Edwards, 2013; Lochner, Rieckmann, & Robischon, 2019; Slabe, 2017). The Mean Score of the Students Scientific Attitude based on Each Statement can be seen in Table 3.

In this research, the innovative green garden-based education characteristics adopted by school garden initiated by FAO (2009). The activity started with the introduction of characters from plants specifically for morphological characteristics. The morphological characteristic can be recognized by observing plant growth type, plant size, stem pubescence density and length, leaf type, corolla color, the color of immature and mature fruit, seed shape and color. It is a basic concept that important to know if we want to learn about plant (Chime, Awansoba, Osawaru, & Ogwu, 2017; Wolsey & Lapp, 2014). Students learned to distinguish the types of plants and about the plants classification. Then, students learned about how to cultivate the plants. Students practiced hands-on experience after mastering the concept. Students were given seeds based on the selected plants that they are interested, including: tomatoes, chilies, spinach, watermelons, mustard greens, melons, ginger. They planted many kinds of plants in groups. The students used the various planting media, including wall gardens, raised bed, pots, and verticulure that contain soil, husks, organic fertilizer. Each group was responsible for each plant that they planted. During the course, each group had different experiences depending on the type of plants and soil media used. Students were asked to observe the plants’ growth whether plants are grown well or not. Students also learned to provide organic compost using the vermicompost that has been provided. The students observed the plants and pests that appear along the plants growth. They also observed the morphological characteristic of each pest. If the students got problems or obstacles in the process of planting they might work together with their friends or ask the teacher for help as a facilitator. All of the observation results were recorded in a module. Observations were
carried out until the time the plants were ready to be harvested. At the end of the program students could harvest garden products and process them for sale or for consumption.

Table 3. The mean score of the students' scientific attitude based on each statement

| The scientific attitude elements | Number of item | The statements | Mean score |
|---------------------------------|----------------|---------------|------------|
| Curiosity                       | 20.            | The researches we do in the innovative green garden-based education course are boring for me | 4.7        |
|                                 | 10.            | I am willing to do research on natural events | 4.7        |
|                                 | 27.            | I have many questions in relation to the activities during the innovative green garden-based education course | 4.4        |
|                                 | 8              | I want to know about the characteristic of plants and how to grow the plants well | 4.7        |
| Rationality                     | 15.            | I do not believe about a fact before I have the evidence | 3.6        |
|                                 | 5              | I always form my result reports based on observations and experiments | 4.2        |
|                                 | 17.            | Using scientific methods help me think correctly. | 3.9        |
|                                 | 7              | I can logically interpret my experiment results. | 3.2        |
|                                 | 26.            | I use scientific processes to decide correctly. | 3.5        |
| Open mindedness                 | 28.            | I think scientific and technologic inventions are hazardous rather than beneficial. | 3.9        |
|                                 | 25.            | I trust the results of the researches following scientific processes. | 4.1        |
|                                 | 4.             | I can use appropriate resources for the solution of the problems I face during innovative green garden-based education course. | 3.9        |
|                                 | 13.            | The innovative green garden-based education courses help me consider other's thoughts during decision making | 4.1        |
|                                 | 21.            | I accept the results written in books if they are different from my experiment results. | 3.6        |
| Critical thinking               | 2.             | I can easily compose questions related to my research topic. | 3.2        |
|                                 | 6.             | I can look at my experiment results with a critical eye. | 3.2        |
|                                 | 16.            | What I learn in innovative green garden-based education course helps me explain my opinions easily to the other people. | 4.1        |
|                                 | 11.            | I do not care about my research result | 3.9        |
|                                 | 23.            | I do not care about my friends' opinions in discussions during the innovative green garden-based education course | 4.4        |
|                                 | 18.            | I prefer working alone rather than working with my friends on topics that I need to do research. | 4.7        |
|                                 | 14.            | I always ask my friends to help me if I have a problem | 4.7        |
| Honesty                         | 9.             | I always write exactly what I observe about the experiments that I do. | 4.4        |
|                                 | 19.            | I never cheat to my friend when I collect the data | 3.4        |
|                                 | 24.            | Sometimes, I do not say the truth to my teacher or my friend during the innovative green garden-based education course | 3.8        |
| Persistence                     | 12.            | I can give up my work if it is too long and requirement much effort | 3.6        |
|                                 | 22.            | I think I cannot manage to do the tasks I am assigned to during the innovative green garden-based education course. | 3.6        |
|                                 | 3.             | I can easily handle the problems I face during my researches. | 3.5        |
|                                 | 1.             | I always follow the methods during the course which are similar to scientist's works. | 3.6        |

Source: adopted from Yasar and Anagun (2009) and Pitafi et al (2012).

In general, school garden has common focus on growing plants in a few pots or in schoolyard. Gardening programs are flexible in all shapes and sizes fit with the needs and resources of every school (Alderson et al., 2015). The International Institute for Rural Reconstruction describe that it is needed some features to promote school garden resilience: school garden must use organic fertilizer, must have at least 200-㎡ garden bed and deep dug at least 1 ft, good water source, proper drainage system, and use mulch to protect soil (Angeles-Agdeppa, Monville-Oro, Gonsalves, & Capanzana, 2019; De Vlieger, Riley, Miller, Collins, & Bucher, 2018). Running a school garden requires some knowledge, people skills, and common sense that related with how to...
plan and manage, find resources, collaborate and motivate with those involved, and organize garden work and lessons (FAQ, 2009; Sherman, 2010).

The perception of teachers and students toward the implementation of green garden based-education
innovative green garden-based education

Learning science through innovative green garden-based education helps the student to work as a scientist. They can collect the data through scientific methods including observing, measuring, experimenting, analyzing, and concluding. It gives experience for students to be able to apply concepts obtained in the classroom to the real world. The activities in gardens can increase the scientific attitude of the student because gardens can be used as living laboratories where students observe what they are learning and implement the knowledge (Erdogan, 2017; Greer et al., 2019; Passy, 2012).

Consistently, the perceptions of teachers and students figured that there are many positive effects of the innovative green garden-based education implementation. The activities lead to hands-on experience and engage high order thinking skill. The teacher emphasizes that the innovative green garden-based education can provide a hands-on learning. They can apply their knowledge to real world situations (Humberstone & Stan, 2011). Outdoor experiences engage high order thinking skill and the understanding about the concept. The activities also help students improve their scientific attitude in relation to rationality, curiosity, critical thinking, and persistency. According to Revati & Meera (2017) science teachers have to know the importance of making connection between science and student’s life. The learning of science should emphasize on activities that enhance student’s experiences in order to relate it to their daily life. The teacher should organize learning environment which has a positive effect for scientific attitudes (Balaji, 2017; Erdogan, 2017; Prince, 2019). By doing this, students can realize that their knowledge are important and valued. They can improve their self-concept in science. Teachers find the garden is a moderately to very effective tool for teaching science. 3 aspects of school gardens as opportunities to address time- and staff-related issues: strengthening of garden committees, professional development, and community outreach (Burt, Luesse, Rakoff, Ventura, & Burgermaster, 2018). But there are some limitations based on teacher perception of the innovative green garden-based education implementation such as time consuming and requiring wide and large spaces. Selected responses regarding the implementation of innovative green garden-based education by the teachers and students can be seen in Table 4 and Table 5.

Table 4. Selected responses regarding the implementation of innovative green garden-based education by the teachers

| Theme: The strength and the weakness of the implementation of innovative green garden-based education and the students scientific attitude toward the implementation of innovative green garden-based education |
|-------------------------------------------------|
| Learning science in innovative green garden-based education can motivate the students to and give the real experience related to the science concept (rationality). |
| Some activities are time consuming. The teacher must well prepared to manage activities based on innovative green garden-based education module so that the activities are conducted effectively. |
| There are many questions is asked by the student during the innovative green garden-based education activities (curiosity, critical thinking). |
| The activities help students have responsibility for their tasks, promote their critical thinking and problem solving (persistency, critical thinking). |
| It will be a benefit for school that has wide and large area, but it will difficult for school with the limited area. |

Table 5. Selected responses regarding the implementation of innovative green garden-based education by the students

| Theme: The strength and the weakness of the implementation of innovative green garden-based education and the students scientific attitude toward the implementation of innovative green garden-based education |
|-------------------------------------------------|
| I feel that gardening is one of the way to learn about science in real way, we are not only sit and listen the explanation from our teacher, but also we do many interesting activities. |
| I like to cooperate with the other friend when I did my task in during innovative green garden-based education (cooperation). |
| Learning science through innovative green garden-based education is very interesting (curiosity). |
| Sometimes, I still feel shy to express my opinion in front of the others in class but this activity encourage me to ask and express my opinion (curiosity and critical thinking). |
| I think worms is harmful for us, actually I just know that the worm has many benefit for environment (open mindedness). |
| I want to know why the plants has different growth in size although located in the same media (curiosity). |
| I listen carefully to our gardening teacher (persistency). |

The students state that the activities during the innovative green garden-based education course develop their scientific attitude including cooperation, curiosity, critical thinking, open mindedness, and persistency. They feel more interested in outclass activities than classroom activities. They are encouraged to work in teams...
and explore the phenomenon that is happening. The students prefer learning with outdoor activity than just only staying in the classroom (Maynard, Waters, & Clement, 2013b). Garden-based education can capture students’ interest and energize their learning. The learning outcome of students who joined in a hands-on school gardening program was higher than the students who did not participate in gardening activities (Greer et al., 2019; Maynard, Waters, & Clement, 2013a). Many aspects to consider when comparing outdoor educational settings; the comparison of purposes, aims, pedagogy, outcomes, (Almers, Askerlund, & Kjellström, 2017). Skinner (2015) states that the engagement in the garden is positively and significantly correlated with student self-perceptions, competence, autonomy, intrinsic motivation, and school achievement. Similarly with the study conducted by Hammarsten et al. (2019) about the student’s perspectives on a forest garden, they have positive feelings on a forest garden including the activities caring for the organism living there. It can develop the ecological literacy; practical competence, learning how to co-exist and care, and biological knowledge and ecological understanding.

The implementation of garden programs also significantly influences students’ environmental attitudes (Malberg & Wistoft, 2018; Wolsey & Lapp, 2014; Verde & Valdés, 2013). The former research on school gardens indicates a positive reaction toward nutrition habits when implemented into the curriculum (Hamulka, Wadolowska, Hoffmann, Kowalkowska, & Gutkowska, 2018). The students have the ability to change their attitudes through garden programs (McCarty, 2013; Murakami, Su-russell, & Manfra, 2017; Wolsey & Lapp, 2014).

However, there are some limitations of the implementation of innovative green garden-based education such as time consuming and in some case, it need a wide green area. The school that applies green garden-based education must be well-prepared so that the course is conducted effectively. Kupolati, Macintyre, Gericke, & Becker (2019) said that there is no universal model of green garden-based-education that can be implemented to every community. Each culture or community has to design a plan that addresses the needs of its learners and educators (Greer et al., 2019). By applying the hands-on curriculum enhance students’ interest in science with no loss of science content (Sheldrake, Mujtaba, & Reiss, 2017). The sustainability of the implementation of green garden based-education should be a responsibility of multiple stakeholders across the school (Duram & Williams, 2015). The conceptual model of potential effect of school garden program that explain about short-term, long-term effect, and the interconnections between individual, family, school and community-level effects can be considered (Clague, 2018; Davis, Spaniol, & Somerset, 2015; Ohly et al., 2016).

CONCLUSION

The students have positive attitude toward the implementation of innovative green garden-based education with highly positive attitude in curiosity and cooperation elements, and moderately positive in open-mindedness, rationality, critical thinking, honesty and persistency. The teacher and students emphasize many advantages during the implementation of innovative green garden-based education for learning science especially in forming positive scientific attitude and giving hands-on experiential learning. Based on the findings of this study, the science teacher should facilitate students for learning science not only in the classroom but in the real environment. The green garden based-education curricula can be one alternative as an innovative educational tool for learning science.

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