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STRENGTHENING STUDENTS' CHARACTERS AND ECOPRENEURSHIP THROUGH SCIENCE, ENVIRONMENT, TECHNOLOGY, AND SOCIETY COURSE

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ABSTRACT

The purpose of this research was to strengthen characters and ecopreneurship of students who enrolled in science, environment, technology, and society (SETS) course. The focus of the students' characters in this study included responsibility, discipline, creative and innovative, commitment, and cooperative. This course supports the students to develop ecopreneurship to create products from organic and inorganic waste treatments. To achieve the purpose of this research, a teaching and learning package including syllabus, lesson plan, and assessment criteria were developed using the Research and Development (R&D) method. A total of 42 science education undergraduates and two experts were involved in this research. The data were collected through validation sheets, observation sheets, and assessment of students'ecopreneurship products. The validation results showed that the developed teaching and learning package categorized as very good. In this course, six stages of learning were implemented including identifying a problem, making a plan, conducting an observation, collecting information, exhibiting a product, and writing ideas. The observation results showed that the overall developed teaching and learning package was effective to support the students' learning in each of the six stages. Moreover, the improvement in students' scores on the focused characters was observed. At the end of the course, the students' ecopreneurship products were also accomplished. Nine of the products were made of organic waste, while the two of them were recycled from inorganic waste. Thus, it concluded that the course of science, environment, technology, and society could strengthen the students' characters and ecopreneurship.

Keywords: characters, ecopreneurship

INTRODUCTION

The Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Negeri Surabaya, has KKNI and SNPT curriculum characterized by ecopreneurship. It aims to produce graduates characterized by ecopreneurship. The scope of the success of an ecopreneur-minded learning is through three components, namely: (1) eco-innovation; (2) eco opportunity; and (3) eco commitment (Curriculum Development Team of FMIPA Unesa, 2017). Therefore, the Science Education as one of the study programs in FMIPA also needs to refer to the curriculum of FMIPA.

One of the subjects in the Science Education program, i.e. science, environment, technology, and society of SETS course designs learning that leads students to ecopreneurship. Through the task of identifying scientific issues related to environmental issues, students are expected to apply eco-opportunity. Having the reasoning and creative thinking skills, the students find solutions

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to these problems and develop new environmentally-insightful ideas in entrepreneurship. The process leads the students to do eco-innovation. To achieve the eco-opportunity and eco-innovation, surely, the students must also have eco-commitment which is behavioral characteristics. Through the SETS learning, character education is conducted for strengthening the character of students.

Character education is an attempt to influence one's characters so that s/he could understand, pay attention to, and uphold key ethical values such as respect, honesty, responsibility, fairness, and care (Afrizon, et al., 2012).

Why does character education need to be grown in the SETS course? It is because students of the younger generation who are also citizens should have positive, creative, critical, and trusting attitudes and behaviors in order to hold the nation's leadership baton in the future. Students should act as the agent of change. These attitudes and behaviors are needed to face the increasingly tight competition in the global era (Winarsih, 2015).

The results of observation and interview with the students found that the students have not taken a role in environmental management. In the interdisciplinary lectures discussing environmental issues, students were able to identify the types of garbage found in the campus and surrounding environment ranging from dry leaves, various plastic waste, paper, and so on.

They knew that waste is classified into two; organic and inorganic. The organic waste could be processed into compost, etc., whereas the inorganic waste could be recycled into handicrafts, and so on, but only thirteen percent of the students involved in environmental management for waste utilization. The researchers argued that the students need to be directed to do positive things that they already knew, thus, they could play a role in environmental management. Another supporting thing is the result of the garbage identification done by the students, a lot of materials were obtained and used as learning resources and processed so as to have economic value.

Starting out of this background, the researchers designed a lesson integrated with character education and ecopreneurship in SETS course. The goal was to strengthen the character of students including responsibility, discipline, commitment to work, creative-innovative, and cooperation. A character is a way of thinking and behaves for each individual to live and work together, either within the scope of family, society or nation. (Maryono, 2015). The character configuration in the context of psychology and sociocultural could be divided into four processes, which are: thinking (creative and innovative), feeling (responsible), working (work ethic), and exercising (discipline and cooperative/ cooperation) (Maryono, 2015).

The character formation is essential and urgently done. We have to build nice characters, ethics, and attitudes to develop this nation (Suastra et al., 2017). Human resources having good characters are required in national development (Suastra et al., 2017). This research's novelty takes place on the character building which was combined with ecopreneurship. Why? Since learning strengthens the character and fosters the ecopreneurship through environmental awareness by finding problems related to waste, finding solutions, conveying ideas, and developing inventions/innovations of organic and inorganic waste processing to produce goods/crafts. This is in line with Adinugraha (2017), who revealed that entrepreneurial skills could be cultivated through the making of Biology learning media made of paper, cardboard, iron/zinc, wood, and electronic devices. Similarly, Widiyatmoko & Pamelasari (2012), developed and produced IPA learning tools by utilizing secondhand materials.

The importance of learning includes: (1) enhancing concept understanding on Science related to organic and inorganic waste, its processing and utilization, so that students are able to create more innovations; (2) cultivating environmental care to the students by minimizing waste through the 6R processes (refine, reduce, reuse, recycle, recovery, retrieve energy), and (3) equipping students with ecopreneurship skills through the utilization of materials that having no economic value. There are twenty indicators of ecopreneurship and one of which is environmental education (Moghimi & Alambeigi, 2012; Pichel, (2008).

Seen from the above three purposes, those are in accordance with the demands of the SNPT-KKNI curriculum that sets S1 students to have attitude competencies, general skills, special skills, and knowledge mastery (Endrotomo, 2015).

To run the KKNI and SNPT curriculum characterized by Ecopreneurship, it is essential to choose appropriate learning approaches/ methods, design learning scenarios, select assessment techniques, develop the instruments, and interpret the assessment results (Curriculum Development Team of FMIPA Unesa, 2017).

Related to the implementation of KKNI and SNPT curriculum characterized by Ecopreneurship, the planning stage began by examining

the character in SETS course. The researchers, in addition to adopting the definition of character from Maryono (2015), also adopted the opinion of Machin (2014), that character is related to the understanding (head), caring (heart) and acting in accordance with the main ethical value (hand). Thus, character education should cover the above three aspects (head, heart, hand) through habituation.

There are four types of character that could be developed during the educational process, which are: (1) cultural-based character education, which is the truth of the God's revelation; (2) cultural-based character education, for instance, in the form of manners, Pancasila, literary appraisal, exemplary historical figures and national leaders; (3) environmentally-based character education; and (4) self-potential-based character education, i.e. personal attitudes as the result of self-awareness process on self-potential. Those are directed to improve the quality of education (Machin, 2014).

In line with the above opinion, the SETS course was designed on character-based and self-based character education. The students can act as agents of changes, through creative, critical attitudes and behaviors developed in learning covering the aspects of the process, person, environment, and product (Winarsih, 2015). In the process, the students are expected to show an interest in discussion, solving problems, assignments, and working together.

Individually, a student must highly commit to assignments, as seen in his/her discipline and tenacity. Students must be able to identify and solve environmental problems and provide solutions to overcome it. The solution is expected to lead them to create innovative, novelty, interesting, and useful works/products.

In this context, character education is highly relevant to be inserted in SETS lectures, as it combines four components of science, environment, technology, and society. The characters are integrated with values using constructivist and constructionist ways. The constructivist explains that students build knowledge through their interaction with the environment. By building an investigation, communication, or activity, a student could build new knowledge and relate it to their prior knowledge.

Khusniati (2012) stated that learning by making use of prior experience can help students construct learning materials. Moreover, learning by doing could increase students' active participation. The constructionist tells that an individual can grasp best when s/he builds a work that can be shared and judged. Another important element of constructionists is that the work produced must be personally meaningful, in which students can be interested in what they learn or do in the learning process. This corresponds to character education which is a development curriculum aimed at teaching students to make informed and responsible choices for acquiring the required knowledge, skills, and abilities (Tannir & Al-Hroub, 2013). Considering the foregoing, the constructivist description in the SETS lecture is that the students try to identify environmental problems and extract information to solve the problems. In this step, the students would interact with their friends and the people around them (informants) to obtain information, so that they can gain new knowledge.

At the constructionist stage, the students combine new information with their prior knowledge to provide solutions to environmental problems and create technology-based works by utilizing inorganic and organic waste that can be shared with others. For example, how rice husk can be transformed into something more beneficial like compost.

The students' positive attitude toward ecopreneurship will arise if they realize that it is not easy to find a job. In addition, it is not easy to start a business without a determination to be successful. Therefore, the SETS course directs students to produce goods that can be sold to the public. It is appropriate if the integration of character education is also followed by developing the ecopreneurship. Thus, students do not have to think about "where I should go to work", they are no longer a job seeker, rather, they would think of "what kind of work they can do to develop themselves and their environment". In other words, they are job creators (Sulistyorini, 2013).

There are 4 (four) competencies formulated in this SETS lectures, which are: (1) Making use of Science and Technology to identify the environmental problems or science, environment, and technological issues. Also, to find alternative solutions based on scientific innovation, environment, technology, and community; (2) Mastering science, environmental, and technological concepts and its application in everyday life to review alternative solutions on science, environmental, and technological problems, also, to develop innovation based on science, environment, technology, and community; (3) Making strategic decisions in accordance with the observation and Science theory study to pick and decide solutions on science, environmental, and technological issues. Also, to find alternative solutions based on

scientific innovation, environment, technology, and community; and (4) Responsible for the assignments presented in the form of proposals, reports, and scientific articles. Avoiding detailed references and research result presentation

METHODS

The method used was Research and Development (R&D), having the steps adopted from Ferinch in Subekti & Hidayati (2013), including planning, design, development, implementation, and analysis. All stages passed through evaluation and revision.

At the planning stage, an analysis on Higher Education applying the SNPT-KKNI curriculum was conducted, in which learning achievement should cover 4 (four) aspects, namely: attitude, general skills, special skills, and mastery of knowledge. These achievements are pursued through the formulation of four competencies as described above. In addition to curriculum analysis, student analysis is also conducted.

According to Piaget in Jansen (2011), there are four stages of cognitive development, namely: sensorimotor, preoperational, concrete operations, and formal operations. Each stage is related to a specific age, so, the student is at the formal operation stage. At this stage, a person is no longer needs concrete objects to make rational decisions. S/He should be able to think abstractly. Therefore, in the process of knowledge dimension, students must be in the category of high-level thinking skill, i.e. analyzing, evaluating, and creating.

In the designing stage, an analysis of the study materials on environmental or community issues was done through identification, the discovery of alternative solutions, the development of invention/innovation based on science, environment, technology, and society in the form of project tasks, arranging proposal, reporting, and scientific publications.

The syllabus was prepared at the development stage, taking into account the indicators of competency achievement. In addition to the syllabus, the lesson plan and the assessment were also compiled. All three devices were validated, before being implemented. The implementation was conducted on the 42 Science Education undergraduates, class of 2012.

The data collection techniques used were observation, validation, documentation, and interview. A descriptive analysis was employed to analyze the data.

The instruments' eligibility criteria were defined using the following equation:

$$\bar{x} = \frac{\sum x_i}{n}$$

Information:

$\bar{x}$ = the mean validity

x_i=the validity score of the i to n assessment aspect

n = number of assessment aspects

For instrument validity:

x_i = the validity score of the i- validator to-n

n = number of validators

The instruments have good validity when $\bar{x} \geq 3$, based on the criteria as shown in Table 1.

Table 1. The Validity Criteria

No	Criteria	Score
1	Very high	3,1 – 4,0
2	High	2,1 – 3,0
3	Moderate	1,1 – 2,0
4	Low	0,0 – 1,0

(*Best & Kahn*, 2006)

The criteria for the learning implementation were determined based on observation scores were done by two observers. The agreement between the observers was calculated by the Kappa coefficient equation.

$$Kappa = \frac{Po - Pe}{1 - Pe}$$

Information:

Kappa = The coefficient of agreement between observers

Po = The value of the observed agreement

Pe = The value of the expected agreement

(*Walker, R.A.,* 2011)

The Kappa coefficient criteria can be seen in Table 2 below. The learning implementation is considered good, if the Kappa coefficient≥ 0,61.

Table 2. The Kappa Coefficient Criteria

Score	Criteria
0,81 – 1,00	Very good
0,61 – 0,80	Good
0,41 – 0,60	Moderate
0,21 – 0,40	Low
0,00 – 0,20	Very los

(*Walker, R.A.,* 2011)

The instuments' effectiveness was assessed on the basis of the KKM score of ≥ 61, or 'good' criterion.

RESULTS AND DISCUSSION

The Feasibility of The Learning Devices

The learning devices that are in accordance with the goals to strengthen the character of students and develop ecopreneurship, thus, the learning was designed in a constructivist way. Therefore, the students could build new knowledge through interaction with the environment. They constructed further knowledge, created shared and judged works.

Another important element of the constructionist is that the students' enthusiasm for what they learn so that they are fully engaged in the learning process. As a result, the produced goods are meaningful for them. This is in line with Khusniati's (2012) opinion, that the material will be easy to understand if the students do activities to grasp it.

In the SETS course, learning was structured by following the stages referring to the achievement of the four competencies above. According to the results of Focus Group Discussion (FGD), the developed learning stages of the SETS included: (1) criticizing and planning; (2) collecting data through field studies; and (3) writing and performance. These steps are illustrated in Figure 1 below.

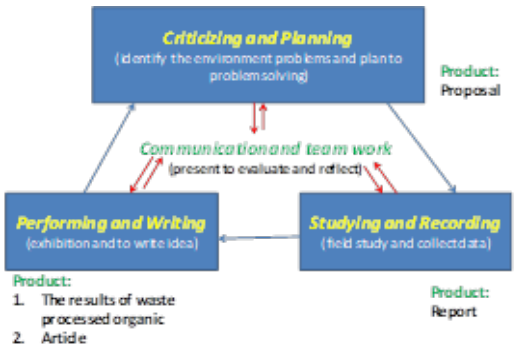

Figure 1. The SETS Learning Stages (Adapted from de Bettencourt K.B., 2000)

The above stages could encourage students to discuss and explore; as a result, it gave the students the opportunity to generate their potential to invent and innovate. This is in line with Zoller (2013), that learning STSE (Science, Technology, Society, Environment) can change: "teaching" to "learning", "knowing" to "thinking" and "teacher-centered, authoritative, frontal instruction" to" student-centered, real-world, project / research-oriented team learning".

To support the character and ecopreneurship-based learning implementation, the learning devices were developed, consisting of the syllabus, lesson plan, and assessment. The validation results by the experts on the learning media are presented in Table 3

Table 3. The Validation Results of the Learning Devices

The Learning Devices	Score		Mean	Criteria
	V1	V2		
Syllabus	3,54	3,46	3,50	Very high
Lesson Plan	3,58	3,58	3,58	Very high
Assessment	3,50	3,40	3,45	Very high

Based on the validator agreement score, it obtained the Kappa coefficient of 0,847 (very good) for the syllabus,0,667 (good) for the lesson plan, and 0,8000 (good) for the assessment. The sig. Value for the three devices were 0,002; 0,010; and 0,021 respectively. Thus, the sig. < 0,05 (α), Which means that there was a strong agreement between the validators.

The Implementation of The Learning Devices

The SETS learning tools had 6 (six) stages, namely: criticizing/identifying the problems (criticizing); planning (planning); conducting field studies (studying); collecting data (creating); presenting the work through the exhibition (performing), and writing ideas (writing).

At the criticizing stage, the students found environmental issues by making observations on the environment around the place of learning (campus) or around their home. The urgent environmental issues were selected as project task topics which were further outlined in the proposal.

The results of this study showed that in the criticizing and planning stage, in which the students were asked to identify problems and find solutions to these problems, they were able to carry out the task. This is in line with Nuswowati & Taufik (2015) opinion, that learning with problem-solving strategies could build students' thinking processes, involvement, communication skills, and information sharing.

One example problem that criticized by the students was the waste rice husk that has not been fully utilized. The students had the solution to process the waste of straw into fertilizer so that it would have economic value. By studying the techniques of making fertilizer and digging infor-

mation to the sources (fertilizer producers), the group could produce fertilizer made of waste rice husk having almost the same quality compared to the others used by the community. The results of the criticizing and planning stages are shown in Table 4 below.

Table 4. The Results of Criticizing and Planning-Stage

Group	Types of waste processing		Score	
	organic	inorganic	criticizing	planning
I	√	–	87,8	79
II	√	–	64,3	70
III	√	–	83,5	82
IV	√	–	85,7	89
V	–	√	64,3	84
VI	√	–	75,9	77
VII	–	√	67,1	65
VIII	√	–	82,2	88
IX	√	–	85,7	86
X	√	–	72,2	76
XI	√	–	79,4	76

The assessment on identification results at the criticizing stage included: (1) conformity of project tasks; (2) the sharpness of the problems; (3) a review of science, environment, technology, and societyaspects; (4) solutions offered; and (5) data sources. The assessment percentage for the five aspects, respectively were: 0.15; 0.20; 0.25; 0.25 and 0.15. The scores for each aspect were ranging from 1, 2, 3, 5, 6, 7 (1 = Poor; 2 = Very poor; 3 = Less; 5 = Fair; 6 = Good; 7 = Very good).

From the observation results, some groups were quite careful in critiquing the problems in the environment. The results of the criticizing stage showed that the group 1, 3, 4, 8, and 9 achieved a score of≥ 81, and belonged to 'very good' criteria. This was because the members of these groups were students with high achievement index (> 3.5) so that they were able to think critically and respond well to the tasks given, including the task for the next step, which was the planning.

The assessment at the planning stage (proposal writing), covering aspects of the title, situation analysis, problem formulation, application of science concept, clarity of thinking framework, clarity of problem-solving design, clarity of location and resource, completeness of observation, scheduling, bibliography, language. The span of scores for proposals was from 0 to 100.

At this stage, there was a group obtaining the lowest score, which was 65 (group 7). This was due to their lack of clarity of the situation analysis and the problem-solving design. Group presentation activities gave the students opportunities to evaluate and reflect on each task generated. Thus, there was an increase in score over time within the six stages of learning. This is in line with the opinion of Ahmad, et al. (2016), that cognitive development is the construction of thought processes including remembering, solving problems, and making decisions.

The learning outcomes at the studying stage are shown in Figure 2. The criteria for assessment in the studying stage were similar to the planning stage; there was only one additional criterion that was the assessment of the field study results containing the breadth of information/ data obtained from sources/interviewees, and ease of the design. In Abu, et al. (2015) they stated that field studies need to be sustainably done by teachers.

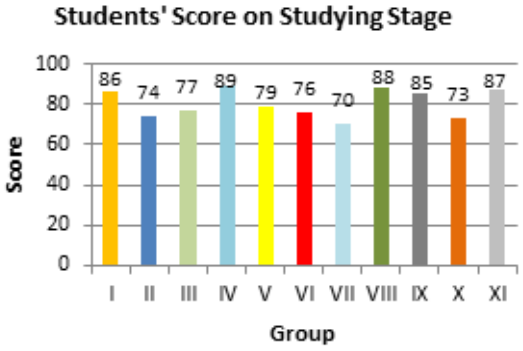

Figure 2. Students' Score Graph on Studying Stage

In addition to preparing reports from field studies, the students also processed organic/inorganic waste into useful products. Here are the student products on the creating stage.

Table 5. Products on the ***Creating*** Stage

Group	Product
I	Straw compost
II	The dregs of tofu chips
III	Handicrafts, planting media, and bioethanol
IV	Anti-mosquito sapray
V	Mornik paper (organic motif)
VI	Balsam babe
VII	Tissue box, leaf-patterned dress
VIII	Bioflow
IX	Biogas
X	Alternative fuels
XI	Bioethanol

At the performing-writing stage, the students displayed their works by holding an exhibition followed by all groups. The assessment at the performing stage included: product, stand appearance, and the ability to present/elaborate ideas. The products were graded in terms of creativity and innovation of ideas, neatness, suitability of material selection, economic value, and benefits in everyday life. The stand performance was scored by its harmony with the decided theme, neatness, cleanliness, creativity, and stand layout. The ability to present and elaborate ideas were rated by how they describe the products briefly and clearly, also, their ability to answer the jury's questions about the products. The rubric assessment for each aspect was: 1 to 4. Score 1= not in accordance with the theme and not interesting, score 2 = not in accordance with the theme yet interesting, score 3 = suitable with the theme but not interesting, and score 4 = suitable with the theme and interesting.

In the final stage, writing, the students wrote down the results obtained from the beginning to the final stage in the form of written ideas/scientific articles or student creativity proposal.

The observation results of the implementation of learning devices by two observers are presented below.

Table 6. The Observation Results

Stage	Mean	Kappa Coefficient	Sig.	Criteria
Criticizing	3,64	0,744	0,000	Good
Planning	3,86	0,588	0,002	Fair
Studying	4,09	0,725	0,001	Good
Creating	4,18	0,569	0,022	Fair
Performing	3,95	0,863	0,000	Very Good
Writing	3,91	0,750	0,000	Good

According to the agreement scores between the observers, the sig value. for all stages was <0.05 (α). Thus, there was a strong agreement between the two observers.

The Effectiveness of The Learning Devices

Seen from the project assessment tasks on all stages, it found that 10 groups had reached the mastery learning ≥ 75. There was only one group that has not reached the mastery learning, since the scores at the three initial stages were low, respectively 67.1, 65, and 70. This was due to their lack of clarity in problem identification and selection of solutions, resulting in an average score of only 73.3. The overall result of the group is presented below.

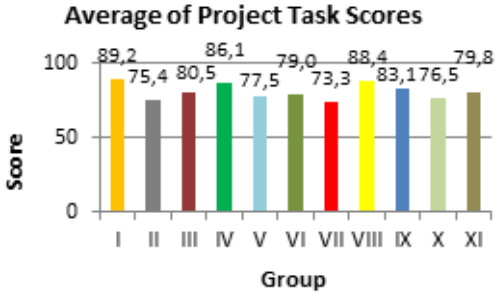

Figure 3. The Overall Results of the Goup

There were 4 groups achieved 'very good' criteria (≥81) and 7 groups achieved 'good' criteria (≥61). Those results showed that the learning was effective. Susilogati, et al. (2014) stated that teaching SETS (Science, Environment, Technology, and Society) course could encourage students to do investigations to gain knowledge. The average scores for the six sta-

ges of criticizing, planning, studying, creating, performing, and writing, are shown in Figure 3.

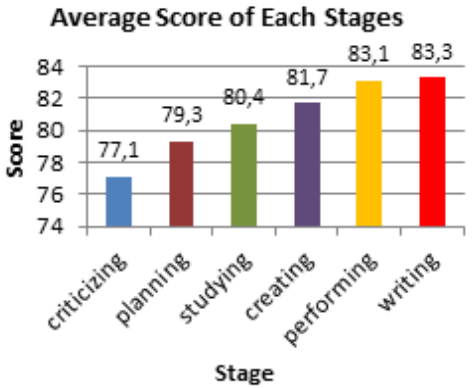

Figure 4. The Average Score of Each Stages

These results indicated that in the first three stages, the students were in the 'good' criteria and 'very good' criteria in the last three stages. Thus, the learning tools were said to be effective.

Character assessment was done throughout the learning process of one semester, including responsibility (completing tasks as required), discipline (compliance with applicable provisions), work ethic (commitment and passion in performing tasks), innovation and creativity, and teamwork. The results of observation/ character assessment on four learning activities of (1) identifying problem; (2) making a proposal; (3) making a report; and (4) conducting exhibitions are shown in Table 6 below.

Table 6. The Character Score on Four Activities

Character	The Activities			
	1	2	3	4
Responsibility	4.00	4.09	4.36	5.00
Discipline	3.91	4.00	4.09	4.92
Work ethics	3.82	4.27	4.36	4.45
Innovation and creativity	3.45	3.45	3.55	4.45
Teamwork	4.18	4.64	4.64	4.72

The four reinforced characters referred to the noble values of character traits (Maryono, 2015) namely thinking (creative and innovative), feeling (responsible), working (work ethic), and exercising (discipline and cooperative/ cooperation).

Considering the above results, in which the project tasks were systematically designed starting from identifying environmental issues and designing the solutions, thus, character strengthening was done gradually. Throughout the lecturing process, the students demonstrated performance and accounted for their work in the forum/class discussion. This is in line with the research result by Rahayu, et al. (2017), that the problem-based learning model is an alternative model to increase the potential of ecopreneurship and character building. Improvement is gained in the creating, exploring, creativity, innovative, and confidence indicator.

At the end of the SETS course project tasks, the students also produced goods from organic/inorganic waste materials that can be distributed/sold to the community. In short, this lecture has cultivated their ecopreneurship sense. Here is one example of the SETS learning outcomes (Figure 4).

Figure 4. The Rice Hust Fertilizier

CONCLUSION

The research results concluded that a teaching and learning package the SETS including the syllabus, lesson plans, and assessment have been validated and declared feasible. Seen from the practicality, the learning devices can be implemented and included in the 'fair' in the planning and creating stage, 'good' in the criticizing, studying, and writing stage, also, 'very good' in the performing stage. For the effectiveness, the learning devices scored 'good' in the criticizing, planning, and studying, and 'very good' in the creating, performing, and writing. There were four groups achieved 'very good', while other 7 groups achieved 'good'.

In accordance with the development and implementation results, given suggestions are as follows:

(1) The learning devices could be implemented in courses having the same characteristics.

(2) The SETS course integrated with 4 aspects of science, environment, technology, and community. Therefore, strengthening on Science and technology aspect is needed to review alternative solutions and develop invention/innovation broadly.

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REFERENCES

Abu, L. Mokhtar, M. Hasan, Z. Sihan, S.J.D. (2015). How to Develop Character Education of Madrassa Students in Indonesia. *Journal of Education and Learning, 9*(1), 79-86.

Adinugraha, F. (2017). Media Pembelajaran Biologi Berbasis Ecopreneurship. *Jurnal Formatif, 7*(3), 219-233.

Afrizon, A. Ratnawulan, and Fauzi, A. (2012). Peningkatan Perilaku Berkarakter dan Ketrampilan Berpikir Kritis Siswa Kelas IX MTsN Model Padang Pada Mata Pelajaran IPA-Fisika Menggunakan Model Problem Based Instruction. *Jurnal Penelitian Pembelajaran Fisika*, *2*(1), 1-16.

Ahmad, S. Hussain, A Batool, A. Sittar K. & Malik M. (2016). Play and Cognitive Development: Formal Operational Perspective of Piaget's Theory. *Journal of Educational and Practice*, *7*(28), 72-79.

Best, J.W. & Kahn, J.V. (2006). *Research in Education*. Tenth Edition. Boston: Pearson.

de Bettencourt K.B. (2000). Science, Technology, Society, and the Environment Scientific Literacy for the Future. In: Kumar D.D., Chubin D.E. (eds) *Science, Technology, and Society. Innovations in Science Education and Technology, vol 6.Springer, Dordrecht.*

Endrotomo. (2015). *KKNI dan SNPT 2014.* Materi Workshop Kurikulum.Tim KKNI dan SN DiktiBelmawa.

Jansen, J. (2011). Piaget's Cognitive Development Theory. *Encyclopedia of Child Behavior and Development*.

Khusniati, M. (2012). Pendidikan Karakter melalui Pembelajaran IPA. *Jurnal Pendidikan IPA Indonesia*, *1*(2), 204-210.

Machin, A. (2014). Implementasi Pendekatan Saintifik, Penanaman Karakter dan Konservasi Pada Pembelajaran Materi Pertumbuhan. *Jurnal Pendidikan IPA Indonesia, 3*(1), 28-35.

Maryono, (2015). The Implementation of Character Education Policy at Junior High Schools and Islamic Junior High Schools in Pacitan. *International Journal of Education and Research, 3*(5), 267-274.

Moghimi, S.M. & Alambeigi, A., (2012). Government Facilitator Roles and Ecopreneurship in Environmental NGOs. *International Journal of Environmental Research, 6*(3), 635-644.

Nuswowati, M. & Taufiq, M. (2015). Developing Creative Thinking Skills and Creative Attitude through Problem Based Green Vision Chemistry Environment Learning. *JurnalPendidikan IPA Indonesia*, *4*(2), 170-176.

Pichel, K. (2008). Enhancing Ecopreneurship Through an Environmental Management System: A Longitudinal Analysis for Factors Leading to Proactive Environmental Behavior. *Sustainable Innovation and Entrepreneurship*, 141-196.

Rahayu, S. Supriatna, N. Kurniawati, Y. (2017). Development of Student Ecopreneurship potential through Learning Based Projects Model in Social Studies Learning (Classroom Action Research in Class VIII-1/ Ibnu Thufail Fitrah Insani II Junior High School. *International Journal Pedagogy of Social Studies, 2*(2), *59-62.*

Suastra, I. W., Jatmiko, B., Ristiati, N. P., & Yasmini, L. P. B. (2017). Developing Characters Based on Local Wisdom of Bali in Teaching Physics in Senior High School. *Jurnal Pendidikan IPA Indonesia, 6*(2), 306-312.

Subekti, H. & Hidayati, S.N. (2013). Integrasi Biotechnoecopreneurship untuk Mendukung Kompetensi Calon Guru Sains dan Budaya Berwirausaha. Konferensi Nasional "Inovasi dan Technoecopreneurship. IPB.

Sulistyorini, U.T. (2013). Metode Pembelajaran Kewirausahaan dalam Membangun Perilaku Kewirausahaan. *Jurnal Administrasi Bisnis, Vol. 14, No. 1, Februari 2013. ISSN: 1411-4321.* Semarang: Jur Admin Niaga Poltek.

Susilogati, S. Binadja, A. Hidayah, F.F. (2014). Developing Module of Practical ChemistryPhysics SETS Vision Activity to Science Process Skills of Student Teacher. *Greener Journal of Educational Research, 4*(2), 030-035.

Tannir, A., & Al-Hroub, A. (2013). Effects of character education on the self-esteem of intellectually able and less able elementary students in Kuwait. *International Journal Of Special Education, 28*(1), 47-59.

Tim Pengembang Kurikulum, (2017). *Panduan Implementasi Kurikulum KKNI dan SNPT bercirikan Ecopreneurship.*Unesa: FMIPA.

Walker, R.A. (2011). *Categorical Data Analysis for Behavorial Social Science*. New York: Routledge Taylor and Francis Group.

Widiyatmoko, A. & Pamelasari, S.D. (2012). Pembelajaran Berbasis Proyek untuk Mengembangkan Alat Peraga IPA dengan Memanfaatkan Bahan Bekas Pakai. *Jurnal Pendidikan IPA Indonesia*, *1*(1), 51-56.

Winarsih, (2015). *Kumpulan Handout Sains, Lingkungan, Teknologi, dan Masyarakat.* Unesa: FMIPA.

Zoller, U. (2013). Science, Technology, Environment, Society (STES) Literacy for Sustainability: What Should it Take in Chem/Science Education?. *Educación Química, 24*(2), 207-214.