The Learning of Compost Practice in University

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Abstract. The compost as one of the topics of the Urban Farming Movement in Bandung city,
Indonesia. The preliminary study aims to obtain a description of the performance capabilities
and compost products made by students with STREAM (Science-Technology-Religion-Art-
Mathematics) approach. The method was explanatory sequential mixed method. The study was
conducted on one class of Biology Education students at the one of the universities in
Bandung, Indonesia. The sample was chosen purposively with the number of students as many
as 44 people. The instruments were making Student Worksheets, Observation Sheets of
Performance and Product Assessment, Rubric of Performance and Product, and Field Notes.
The indicators of performance assessment rubrics include Stirring of Compost Materials and
Composting Technology in accordance with the design. The product assessment rubric are a
Good Composting Criteria and Compost Packaging. The result of can be stated most students
have good performance. However, the ability to design of compost technology, compost
products and the ability to pack compost are still lacking. The implication of study is students
of Biology Education require habituation in the ability of designing technology.

1. Introduction
Currently, urban areas are experiencing the problem of reducing agricultural land [1]. Urban Farming
Movement as an alternative to solving the narrowing of urban land. Garbage in the city can be a
potential for Urban Farming. Garbage in urban areas is mostly biological waste (organic waste).
However, the urban community involvement in waste management is still lacking [2]. Urban waste
can be used for composting. The compost is used as a medium for growing of plant in urban farming
[3].

One of the classic problems in Indonesia is the increase of the graduation rate each year that is
always followed by a rise of unemployment [4]. In Indonesia, to synergize the University graduates
with the needs of the workforce, Presidential Decree number 08 of 2012, regarding KKNI (Indonesia
National Qualifications Framework) was released [5]. The condition is suitable to KKNI in term
learning outcomes that should be done by graduates according to the under graduate profiles. The
under graduate profiles on Biology Education Studies Program of one State University on Bandung
are Biology Educators of secondary school, Educational Researcher and Edupreneur [6].

One approach to learning that can be done to prepare the under graduate profile through STREAM
(Science-Technology-Religion-Art-Mathematics). STREAM is the development of STEM that have
been developed in other countries, example United States [7], Japan, Australia [8], Turkey [9], Malaysia [10]. STREAM is following the steps in the form of cycle design engineering process that include: Ask, Imagine, Plan, Create, Improve back to ask and so on. Ask: starting with step questions about the problems being faced. Imagine: to think and use their knowledge and creative ideas to solve the problems. Plan: think of the ingredients/materials/resources for making technology. Technology is used to solve the problem. Create: create a design and follow a plan that has been created in the previous steps. Improve: analyzing technology made whether to work or not, change back design to produce better technologies [8]. Religion indicator associated with religious attitude. Religious attitude are to respect, appreciate and practice the teachings of the religion professed [11]. Religion adopted in this research is Islam because in the Islamic University. Art is meant in this study that creativity, innovation, technology and design in making the resulting product [12] [13]. The Next Generation Science Standards issued a framework for students ranging from kindergarten to grade XII. This framework helps students to build three-dimensional learning. Three dimensions include scientific and engineering skills; the concept of cross-cutting (cross-cutting concepts) in studying science and engineering; and understanding of the core material in the study of science [7].

STREAM suitable learning approach using performance assessment and product. In the realm of skills by observing and evaluating student demonstration. In the realm of product can assess skills with steps to creating quality products and products that can be evaluated [14]. In the assessment of performance and product use guidelines on the assessment rubric. The one form is an analytic rubric with specific criteria [15]. The creating of performance rubrics that represents all stages of ability that needs to be assessed [16].

The study has been conducted in Biology Education has a biology garden facility and close to market. There are many organic waste in market. Based on this background made formulation of the study problem are description of the performance capabilities and compost products made by students with STREAM approach. Further the study questions were made, among other: the student's ability in stirring of compost materials, the student's ability in composting technology, the student's ability to produce of compost, and the student's ability in packaging of compost. The preliminary study aims to obtain a description of the performance capabilities and compost products made by students with STREAM approach.

2. Method
The method of explanatory sequential mixed methods design. The first, collecting quantitative data and then collecting qualitative data [17]. The quantitative data derives assessment of performance and product assessment by making a percentage. Purposive sampling is a Biology Education student of 6th semester of class A. Purposive sampling because class A has more male students than class B. The sample number of students as many as 44 people. It consist of 10 male students and 34 female students.

Students have been divided into composting groups. The one group consists of 3 people to facilitate observation and enable student performance in composting. The qualitative data comes from field notes during the descriptive practice.

The instruments has been validated by 2 fellow lecturers, 1 expert of Biology Education and 3 experts as advisory commission. The indicators of performance assessment rubrics include Stirring of Compost Materials and Composting Technology in accordance with the design. The product assessment rubric are a Good Composting Criteria and Compost Packaging.
3. Result and Discussion

3.1. The student's ability in stirring of compost materials (performance assessment)

Figure 1 shows the performance results in stirring of compost materials indicator. Figure 1 shows that the student performance of 40.91% is categorized very good; 52.27% is good categorized; and 6.82% is enough categorized. The results show that most of the students have good performed in compost materials stirring. Based on field notes, students have been seen actively doing materials compost stirring. The materials used come from the remaining vegetables from market. Students also have utilized the tools and materials that exist around in the Biology Garden.

Figure 1 shows the performance ability of most students is good. The results are in line with the Septiani study that the performance assessment applied in the STEM approach to plant media preparation materials has been able to reveal the skills of the science process [18].

![Figure 1. Figure of performance assessment of materials compost stirring](image)

3.2. The student's ability in composting technology (performance assessment)

Figure 2 shows the performance results on composting technology that match the design. Before of the compost practice, students have been assigned to make composting mini-proposal according to worksheet. The mini-proposal contains the problem of composting, how to solve compost problems, compost theory, determining tools, materials, work methods, and composting design. Students have been assigned to draft compost cost budget and composting relationship with religion aspect. Figure 2 shows all under categorized students in designing of composting technology. Students have difficulties in designing of composting technology. Based on field notes and observations that the tools, materials, and workings of composting that have been written in mini-proposal were inconsistent with the compost practice. Students were not familiar with STREAM worksheet. Students felt limited time to made mini-proposal.
3.3. The student's ability to produce of compost (product assessment)

Figure 3 shows compost product assessment produced by students. The results showed that the compost product among others 14.00% is very good categorized: 12.00% is enough categorized: and 74.00% is poor categorized. These results have shown that most of the compost that students have made is not good enough and has done repetition of composting.

Based on figure 3 most of the students have done repetition of composting and until this report has not produced compost. It is in accordance with the STEM stages of the Improve Stage by analyzing the technology made whether to work or not, changing the design back better [8].

3.4. The student's ability in packaging of compost (product assessment)

Figure 4 shows the assessment in packing of compost. The compost packaging deals with the Art in STREAM approach. Figure 4 shows that students' ability to pack of compost among others 14.00% is very good categorized: 14.00% is enough categorized: and 72.00% is poor categorized. These results have shown that most of the compost packing is still the same as other groups. Based on field notes, students did not give reasons for selection of packaging and less attractive packaging. The compost package chooses was a plastic that has no pores.
STREAM perspectives used in this study is a perspective originated from STEM ie technology, engineering, and mathematics that are intercepts are in the science [19]. STEM added aspects of religion and art become of STREAM. It is chosen because the technology, religion, engineering, art and mathematics involved are interrelated and supportive of science. Crosscutting Analysis Concept of STREAM which refers to STEM. Cross-cutting concept facilitates students to make interdisciplinary connections: Science, Technology, Religion, Engineering, Art and Mathematics. Crosscutting concept will make students better understand science and engineering in theory and practice [7]. Cross-cutting Concepts Analysis of Composting is presented in Table 1. In general, based on the results of study shows that students' ability in designing technology is still lacking. This condition causes the compost and packing ability to be less good.

### Table 1. Cross-cutting concepts analysis of composting

| Concepts that Surround of the Subject Matter (Science) | Process: Ask-Imagine-Plan-Create-Improve |
|------------------------------------------------------|------------------------------------------|
| 1. The type and composition of compost materials | Ask: The identifying of problem and made of problem formulas |
| 2. The success factors of composting | Imagine: The looking for solution to the problem of composting |
| 3. The good compost traits | Plan: The determining tools, materials, and designing compost technology |
| | Create: The making compost according to the design that has been made |
| | Improve: The analyzing and testing of composting result according to the function. |

**Cross-Cutting Concept**

1. Cause and effect: mechanism and explanation
2. Scale, proportion and quantity
3. Energy and matter: Flows, Cycles and Conservation

**Explanation**

1. Cause and effect: Students were guided to analyzed the causal effects of the good compost can affected plant growth. In this study, the application of compost in seeding of kale plants for the aquaponic system. The next learning was aquaponic system.
2. Scale, proportion and quantity: A bridge between science and mathematics in determined the composition of compost materials and making of EM4 (effective microorganism 4) solution.
3. Energy and matter: Flows, Cycles and Conservation: The composting requires energy from the environment for the fermentation process. The fermentation process of aerobic produces humus, carbon dioxide, and heat [3].

**Technology**

1. The using simple tools in composting
2. The using container to accommodate the result of mixing of

**Religion**

1. The appreciate the teachings of Islam: taking care of God’s natural resources of taking care of compost by placing in a shady place. The observing every day to avoid drought on compost. When the dried compost is added with water and stirred until evenly distributed. The observation has been done until the compost into humus is marked by the color change to black (colour soil), crumbled (crumb / dry

![Figure 4. Figure of Product Assessment of Compost Packaging](image-url)
The teachings live of Islam: thank God for the available natural resources. The rest of the organic waste and the presence of microorganisms can be utilized for plant life and fertilize the soil.

2. Implement the teachings of Islam (doing, fulfilling, delivering): the composting to give goodness to the environment as a form of worship that will earn reward from God.

### Engineering & Art

| Engineering | Art |
|-------------|-----|
| 1. The design composition of compost materials and tools already available in the surrounding environment | 1. The creating innovative and creative of composting technology |
| 2. The made of materials composting container design that have been stirred (composter) | 2. The interesting packaging of compost. The compost packaging still maintained the compost quality. |

### Mathematics

| Mathematics |
|-------------|
| 1. The calculating on the tools and materials needed for composting |
| 2. The determining on the composition of materials compost that have been used |
| 3. The calculating of the EM$_4$ (effective microorganism 4) solution that has been used as starter composting |
| 4. The calculating on the required cost budget for composting |

(The Cross-cutting Analyses adopts Bybee’s, 2013 and developed by Agustina, et. al, 2017)

### 4. Conclusion

The conclusion of preliminary study is students' performance ability in composting of compost materials is mostly good. However, performance ability in designing technology is still lacking. Most of the students are still not good in compost and compost packaging. Thus, students of Biology Education require habituation in the ability of designing technology for other learning especially STREAM learning.

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