

Learning Science Based on Green Economy to Enhance Student Entrepreneurial Mindset of Secondary School

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Abstract. Entrepreneurial mindset is a factor to mainly concern for the purpose of increasing the number of entrepreneur. The initiation of MEA since 2015 having been requiring the number of entrepreneur in Indonesia to reach at 2% of the population in total. Data based on BPS (a central agency of statistics) showed that in 2017 the number of entrepreneur in Indonesia just reached 1.63%, requiring other 0.37% of the population to be entrepreneurs. The strategic step to develop an entrepreneurial mindset can be through the education by integrating the materials of entrepreneurship and natural sciences. This research aims to measure how much the increase of students' entrepreneurial mindset after having joined the program of learning natural sciences integrated with entrepreneurship is. The learning activity was in concept of learning natural sciences based on green economy with the learning materials regarding with rice-straw fermentation technology for ruminants' fodder. The research was conducted in the secondary school SMP Negeri 1 Purwojati by using non-equivalent pretest-posttest control group design and involving 31 students as the research subjects in each of the experiment class and the control class. The result showed that the average value on the pretest of students' entrepreneurial mindset was 73 for the experiment class and 77 for the control class. The average value on the posttest was 79 for the experiment class and 78 for the control class. The gain score was 0.278 for the experiment class and 0.031 for the control class. ANOVA test showed that there was significant difference of the gain score in between the experiment class and the control class (sig=0.006<0.05).

Keyword : *Learning science based on Green economy, Biotechnology ice-straw fermentation, Entrepreneurial mindset.*

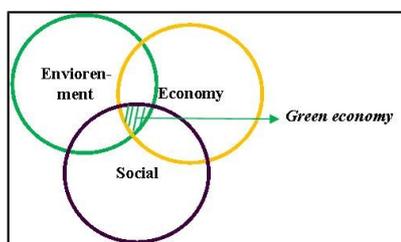
INTRODUCTION

In brief, MEA is an economic regional integration aiming to develop ASEAN to be the single market and the production basis in which service, investment and skilled man power as well as the capital flow can be freer. The initiation of MEA since 2015 has been requiring the number of entrepreneurs in Indonesia at 2% of the population number. BPS (a central agency of statistics) shows that in 2017 the number of entrepreneurs in Indonesia just reached 1.63% requiring other 0.3% still. Finez (2008) considered that an entrepreneur at least has 3 competencies consisting of attitudes, aptitudes, and capacity. The attitudes mean someone's willingness to work on/ create something so that on the other words, the attitudes can also be considered as entrepreneurial mindset. Someone's skill of entrepreneurship starts from the current mindset. The entrepreneurial mindset pin points self-responsibility. It is a self-understanding of interests, entrepreneurship, points of view on entrepreneurial problems, confidence to succeed in entrepreneurship, and positive responses to start the business.

The entrepreneurial mindset is trainable to the students in school learning activities through an explorative discussion to break down the relevant topics with the real situation. Further, the setting

of learning is directed from physical, social, and cultural environment. Learning from the environment enables students to observe and enrich the practical performance. The output is that the students will gain more meaningful experience in learning activities (Madya, 2013). Learning can be such integration between materials of entrepreneurship and surroundings, for instance learning natural sciences based on green economy.

Green economy is identic with the sustainable economic activities to develop the natural resources and the environmental risk (ECO Canada, 2010). It comprises renewable energy, low-carbon transportation system, improved waste management, sustainable management of agriculture and forest, and sustainable fishery. The contribution of green economy is to provide the green works, intensive low-energy resource production, reduction on pollution and waste as well as significant decline green-house emission (Steiner, 2010). The implementation of learning natural sciences based on green economy refers to the three indicators of activities in economy, environment, and social. The economic activities are focused on the agricultural sector by the identification of production process to improve the value of goods. The environmental activities are focused on optimizing the local potentials by pin pointing the character of being care with the environment and its sustainability. Meanwhile, the social activities lay on collective effort to equal social welfare.



(Steiner, 2010)

Green economy on the agricultural sector is possible to implement by processing rice straws for fodder through the fermentation. In this case, the fermentation results in better nutrient composition than unprocessed rice straws. The level of ADF, NDF, cellulose, hemicellulose, lignin, and silica is declined at 20.05%, 18.75%, 25.15%, 16.39%, 35.4%, and 27.95% respectively while the protein level is increased at 107.25%. The decline of fiber fraction is due to the increase in the activity of enzyme produced by the microbes in probion, in charge of degrading, reforming, losing, and splitting the tie between lignocellulose and lignohemicellulose. Krause (2010) reported that a microbe rumen is capable of optimizing the resource of NPN (Non Protein Nitrogen) such as urea and ammonia to convert into protein by binding it in its protoplasm. Here is how the higher protein possibly comes from fermented rice straw than the unprocessed straw. Probion is the mix of various microbes produced though an anaerobe incubation process on the materials of rumen by the additions of mineral and necessary organic materials (Haryanto, et al., 2003).

RESEARCH METHOD (10 PT)

The research was conducted at a state secondary high school SMP Negeri 1 Purwojati in the two classes, each of where 31 students were considered as the participants. One class was an experiment class while another was set to be a control class. In this case, the control class was in treatment of conventional teaching of natural sciences. On the other hand, the experiment class was treated through the learning of green-economy based natural sciences. The measurement of entrepreneurship-mindset variable used pretest and posttest. The design was nonequivalent pretest-posttest control group design (Burroughs, G. E. R: 1975).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Control	O ₁	X ₁	O ₂
Experiment	O ₃	X ₂	O ₄

Details:

O₁ : the average value of control-class students' entrepreneurial mindset prior to the learning with conventional media.

O₂ : the value of control-class students' entrepreneurial mindset after the leaning with conventional media.

O₃ : the value of experiment-class students' entrepreneurial mindset prior to the learning with SSP (Subject Specific Pedagogy) of natural sciences based on green economy.

O₄ : the value of experiment-class students' entrepreneurial mindset after the learning with SPP of natural sciences based on green economy.

The instrument used to measure entrepreneurial mindset was a self-assessment test. The assessment sheet contained the agreement points whose scale ranged from 1 to 5 to be filled by the students. The obtained scores were then averaged for each class and counted to result in gain values by finding the gap between the pretest scores prior to the learning and posttest scores after the learning.

$$\text{Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}} \quad (\text{Freund \& Gain, 2003})$$

The examined hypothesis :

H₀ : there was no significantly-different average of the entrepreneurial-mindset increase between the control class and the experiment class.

H₁ : there was significantly-different average of the entrepreneurial-mindset increase between the control class and the experiment class.

The hypothesis is examined through ANOVA test, H₀ is accepted if the value significance is more than 0.05.

The prerequisite test prior to the hypothesis test (ANOVA) comprised normality test and homogeneity test. The normality test was purposed to identify the dispersion of data and determine whether the data were normally distributed. The normality test was Chi square test on the significance level at 5%. Meanwhile, the homogeneity test was set to ensure if the subject from the population is homogeny. In this case, the homogeneity test was Levine's test at the significance level at 5% ($\alpha= 0.05$).

Table 2. The Instrument Framework of Self-Assessment Test on Students' Entrepreneurial Mindset

Aspects	Indicators	Score	Number
Interest in being an environmental entrepreneur.	1. Feeling pleased to see the surrounding people to be environmental entrepreneurs.	1	1
	2. Feeling pleased to associate with environmental entrepreneurs.	1	2
	3. Feeling interested in being an environmental entrepreneur.	1	3
	4. Willing to learn to be an environmental entrepreneur.	1	4
View Point on Problems	1. Attempting to offer a solution of the problem	1	5
	2. Attempting to look for a solution to be found eventually	1	6
	3. Able to see the opportunity while the others consider it as the problem.	1	7
Self confidence	1. Feeling confident to reach life success.	1	8
	2. In most attempts, I succeed to do something.	1	9
	3. Being capable of given tasks	1	10
	4. Feeling grateful with the current skills.	1	11

	5. Eager to determine what to happen in personal life.	1	12
Response to start business	1. To me, it is valuable to start a business.	1	13
	2. To me, it is fun to start a business	1	14
	3. To me, it is positive to start a business.	1	15
Total		15	

(adapted from : Moberg, et all 2014)

Table 3. The Assessment Scale of Entrepreneurial Mindset

Score	Details	Notation
1	Disagree	D
2	Slightly Disagree	SD
3	Slightly Agree	SA
4	Agree	A
5	Strongly Agree	StA

RESULTS AND ANALYSIS

Learning natural sciences based on green economy comprised a learning containing main materials of rice-straw fermentation biotechnology integrated to the entrepreneurial training in the environment and the society. Kasmir (2016: 21) explained that entrepreneurship pin points someone's capability to creatively and innovatively act to create a business opportunity which benefits to the society. The point of entrepreneurship is to subsequently gather and organize the surrounding opportunity.

The result of research showed that the average value of the pretest on students' experiment class is 73 and control class is 77. After the distinguished treatment, the experiment class in which the students learnt natural sciences based on green economy obtained the average value at 79 in the posttest. The raise on the average value of the entrepreneurial mindset reached the gain score up to 0.238 approximately raised 24%. In the control class, the average value of students' entrepreneurial mindset after the conventional learning of natural sciences is 78. Here the raise on the average value of the entrepreneurial mindset reached the gain score up to 0.031 approximately raised 3%.

Table 4. The Values of Entrepreneurial Mindset in the Experiment Class and the Control Class

Assessment Statistics	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
The average value	73	79	77	78
The average of gain score	0,238		0,031	
Standard of Deviation	7,317089	7,593747	5,990993	8,300912
Minimum value	57	63	64	65
Maximum value	88	93	91	95

The pretest value in the experiment class and the control class was then tested by using Chi-square test with the significance level at 5%. The test resulted in that the significance value is $0.163 > \frac{1}{2}\alpha$ or $0.163 > 0.025$ so that concluded that the samples were normally distributed.

Table 5. The Result of Normality Test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23,758 ^a	18	,163
Likelihood Ratio	30,424	18	,034
Linear-by-Linear Association	4,178	1	,041
N of Valid Cases	62		

Having met with the normally-distributed population, another prerequisite test was homogeneity test. In this case, it aims to meet the assumption that prior to the treatment the control class and the experiment class were equal in ability. Both of the classes should have been in equal variant of the pretest-value data of entrepreneurial mindset. The result showed that the significance value was $0.299 > 0.05$ which then concluded that the students in both classes are equal in entrepreneurial mindset.

Table 6. Levene Homogeneity Test

Levine Statistic	df1	df2	Sig.
1,480	1	60	,229

ANOVA test was purposed to identify the different average of entrepreneurial-mindset value raise in the experiment class and the control class. It showed that the significance value was $0.006 < 0.05$ and $F \text{ test} = 8,133 > 4.00$. It can be inferred that after having learnt natural sciences based on green economy, there was significantly-different average of entrepreneurial-mindset raise in between the control class and the experiment class.

Table 7. The Result of ANOVA Test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,666	1	,666	8,133	,006
Within Groups	4,914	60	,082		
Total	5,580	61			

Learning natural sciences based on green economy is possible to be an initiative of entrepreneurial training at the secondary high school SMP Negeri 1 Purwojati to support and skill the students to succeed in academics and real life in global era. In the United States, Aspen Institute an organization dealing with entrepreneurship development proposed some approaches to inculcate entrepreneurship to the teenagers. The initial step could be the introduction to the new curriculum attracting the teenagers in associating school life with workplace life. In reality, many students joined in surrounding organization and group to develop social entrepreneurship. The program was capable of encouraging students to train to determine the goals, utilize self-consideration in solving problems, and sharpen the creative skills (Payzant, 2008).

Learning natural sciences based on green economy consisted of three steps, 1) natural-resource potential analysis, 2) value-added identification, and 3) micro-scale production. The students conducted the analysis on natural resource by observing the environment around SMP Negeri 1 Purwojati. There, the environment was agricultural fields and just a little part of housing. According to BPS Banyumas, in 2013 the number of agricultural field in Purwojati reached 62% or 2,359 ha of 3,786 ha, the area width in total. Of 2,359 ha agricultural field, the rice field was about 1,005 ha and another agricultural field was 1,354 ha. The result of collecting samples of rice straw after harvest in three different spots of agricultural field around SMP Negeri Purwojati showed that the average of wet rice straw was 2 kg/m^2 . In assumption, if each field results in the same quantity of wet rice straw, the possibly-obtained total of wet rice straw will be 83,415 ton of each 1,005 ha agricultural field.

An entrepreneur is required to be capable of utilizing the opportunity from both self-potential and surrounding potential. Learning natural sciences based on green economy invited the students to be able to optimize the surrounding potential such as rice straws which are relatively abundant in number after the harvest for the purpose of turning into something more value-added. In this occasion, the students theoretically discussed the fermentation process of rice straw to be ruminants' fodder containing higher nutrition. Instead of the fermentation process, the rice straw is a low-quality fodder as the physical structure consists of chemical bond among cellulose, hemicellulose, lignin, and silica which lead to lower digestion (Ranjhan, 1977). The fermentation process involves microorganism which is proteolytic, lignolytic, cellulolytic, and lipolytic as well as fixed non-symbiotic nitrogen to disperse the physical structure (Multifarm, 1999).

In conventional way, students can easily get the microorganism of fermentation agent from the packaged product such as EM-4 farming. Microorganism which plays role as the biological agent in the fermentation process of rice straw comprises *Sacharomyces cereviciae*, *Lactobacillus cassei*, dan *Rhodopseudomonas palustris*. *Saccharomyces cerevisiae* which are unicellular molds in charge of being anti-microbe, anti-cholesterol activity, stimulation effect of immune system, prevention of lactose absorption by the body, diarrhea prevention and anti-mutagenic activity enabling ruminants' digestion work optimally. *Lactobacillus casei* is also in charge of increasing the protein content during the fermentation process as it results in a protein-hydrolyzing enzyme such as peptidase. *Lactobacillus casei* is homo fermentative that it is capable of fermenting glucose into lactate acid up to 90%. Another product resulted by *Lactobacillus casei* consists of citric acid, malate, succinate, acetaldehyde, diacetyl, and asetoin (Speck, 1978). *Rodhopseudomonas palustris* performs as the bacteria degrading aromatic compounds resulted from the fermentation process. The bacteria is phototropic, light as the energy resource.

The third step is the production of fermented rice-straw in micro scale. The students can apply what they have learnt in a way of project work. They work in a group to develop a project framework in the worksheet. They prepare for the equipment and the fermentation materials such as rice straw, water, urea, EM4 farming, cutter, fermenter, and balloon as the indicator. The materials are selected and cut as well as mixed with water, urea, and EM4 farming which are then poured into fermenter and covered with balloon. The students can observe the fermentation result through the indicator of balloon which is bulging or shrinking after the fermentation for 48 hours. The bulge of balloon indicated that the fermentation process occurs and results in CO₂ as the waste substance. In the end of learning, the students communicate their project result in a presentation and the others deliver feedback to create a two-way discussion.

After the entire learning steps, the teachers review the mind flow of environmental entrepreneurship. In brief, the environmental entrepreneurship consists of: 1) the attempt to utilize the opportunity of natural resources, 2) the attempt to create more added values though certain method, and 3) the attempt to produce in micro scale at least. The teachers evaluate the learning activity to re-measure how much the increase of students' entrepreneurial mindset is.

CONCLUSION

Based on the result and the discussion, it can be concluded that learning natural sciences based on green economy comprised some steps: 1) natural-resource analysis, 2) determination of value added, and 3) micro-scale production. Learning natural sciences based on green economy was capable of enhancing students' entrepreneurial mindset at Class IX SMPN 1 Purwojati at 24%, $F_{test} = 8.133 > F_{table} = 4.000$, and $p\text{-value} = 0.006 < \alpha = 0,05$.

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