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The Effectiveness of Bioentrepreneurship Learning Using Comics on the Sub Concepts of Angiosperms for High School Students

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Bioenterpreneurship learning by using comics is one of the contextual learning and can train students' creativity and cognitive abilities. Therefore this study aims to determine the effectiveness of bioentrepreneurship learning using comics, by studying student creativity, students' cognitive abilities, and student responses. This research is a quantitative study with a quasi-experimental method of nonequivalent pretest-posttest control group design. The instruments used for data collection include observation sheets, pre-test post-test, and student response questionnaires. The results showed that the creativity of the experimental class students was better than the control class, the cognitive abilities of the experimental class students improved better than the control class, and the responses of students in the experimental class were included in the strong criteria. Based on the results of the study it can be concluded that learning bioenterprenership using comics effectively increase student creativity, students' cognitive abilities, and positive response from students.

1. Introduction

Tight competition in the global era makes students often faced with problems, so education should contain all the elements of learning outcomes, namely psychomotor, cognitive, and affective. Therefore, learning should encourage students to have skills and independence. Gulo (2008) and Sudjana (2009) state that learning activities are defined when the learning process involves students and makes students active. But the habits in current learning, namely learning in the classroom tend to be oriented to teacher-centered learning (teacher centered), where students get less opportunity to explore their abilities and skills by the intelligence they have. According to Kurawa (2016), students who are studying should have problem-solving skills and understand the scientific method.

Another problem is that learning generally focuses on concept values and still does not apply contextual values that are closely related to real life in society so that students' creativity becomes difficult to shape. Considering the importance of shaping student creativity and increasing student motivation, it is necessary to have the appropriate learning style. It is

expected that learning should be contextual and related to students' daily lives. One of contextual learning is bio-entrepreneurship learning, where bioenterprenership learning is not only related to students' real lives, but it can also encourage students to try to solve problems and can foster creativity.

Several studies on bioentrepreneurship learning have resulted from positive responses. Kristanti et al. (2012) stated that bioentrepreneurship learning is effectively applied to learning activities and can increase student learning interest. Fitriah (2016) Bioentrepreneurship learning can improve life skills and entrepreneurial interests. Fitriah (2012) Bioentrepreneurship learning can improve science process skills, entrepreneurial interests and student learning outcomes. Dewi et al. (2010) stated that the characteristics of devices developed using contextual approaches and observation methods to explore, assign, and make products with waste-based materials have trained the students' ability to expose and inform products. Adlim et al. (2014) in their research related to contextual teaching and learning (CTL), can produce students who enthusiastically explain their business, especially after knowing their development in the capitalist era. These learning activities are bioentrepreneurship or entrepreneurial learning activities.

Kuddus (2013), states that students should have the ability to become entrepreneurial skills because these skills will prepare students to graduate by having innovation and creativity. Also, bio-entrepreneurship learning will be effective because it will involve students in a group discussion for example when carrying out a product of manufacturing tasks. Discussion of students in small groups can activate all group members in learning activities, especially when using teaching materials such as bioentrepreneurship comics that are interesting, so the enthusiasm of students to learn is increasing, and this will increase student creativity and increase cognitive abilities also. Bioentrepreneurship learning activities can be considered more contextual if using interesting teaching materials. Interesting teaching materials can encourage students to be more interested in learning.

Creative abilities can be increased through teaching materials. Creativity needs to be developed in students because through creativity one can actualize himself (self actualization), give satisfaction, and through creativity, someone will be able to improve the quality of his/her life (Safilu, 2010). Current problems of learning are known to tend to be classic and fixated on memorization which encourages students to be less active and creative. Learning resources or teaching materials such as textbooks are often ignored by students

because they are less innovative and less attractive. Therefore, there is a need for innovation in teaching materials. Bioentrepreneurship learning activities can be considered more contextual if using interesting teaching materials.

Interesting teaching materials can encourage students to be more interested in learning. For example, teaching materials that have entrepreneurial characteristics with a more attractive appearance, for example, are associated with comics. Comic teaching materials can improve the learning outcomes of biology (Nurlatipah et al., 2015; Danaswari & Roviati, 2013). Deveci and Cepni (2017) states that entrepreneurial characteristics must be owned by students in the 21st century. Therefore, bioenterepreneurship learning by using comics can create contextual learning. The source of learning in the form of comics is one of the things that can encourage students to respond to more active in learning. The addition of learning resources in the form of comics which are arranged uniquely and also related to the concept of entrepreneurship is the renewal and originality of this research. As a vehicle for implementing bioenterepreneurship learning by using comics associated with entrepreneurship, it is applied to the field of Biology studies in the sub-concept of the Angiosperms.

Based on the description above and considering the importance of efforts to improve creativity and student learning outcomes, the purpose of this study is to examine students 'creativity, assess students' cognitive, and find out the responses of students who apply to learn with bioentrepreneurship using comics in the Sub Concepts of Angiosperms.

2. Methods

This research is a study using quantitative approaches and quasi-experimental methods equivalent to pre-test post-test control group design. In each class, the experimental and control classes were pre-tested to test the initial knowledge, and post-tests to test the final knowledge.

The population in this study were all students of class XI MIPA SMAN 1 Susukan. The sample consisted of 30 students of class XI MIPA 2 as an experimental class and 30 students in class XI MIPA 1 as a control class. Sampling applied is purposive sampling technique. The sample class is divided into control classes with conventional learning, and experimental classes that apply bio-entrepreneurship learning using comics. The research was conducted from April to May 2017.

Data collection techniques applied tests, and non-tests. The test technique uses the comprehension test of the Angiosperm Biology concept, which consists of 40 questions. Non-test techniques in the form of observation sheets are to determine student creativity, and questionnaire sheets to determine students' responses to the applied learning. The statement in the student response questionnaire consisted of 10 positive questions and ten negative questions. The statement in the questionnaire is divided into three dimensions. First, to determine students' responses to the effectiveness of the implementation of bioentrepreneurship learning using comics in the sub-concept of the Angiosperms. This dimension was developed into response indicators for the application of learning, curiosity, and the benefits of learning. Second, to find out the response of students to the learning process of bioentrepreneurship learning using comics. This dimension was developed into four indicators, namely student interest, student activity, ability to re-explain, and student learning motivation. Third, to find out student responses to learning outcomes by applying learning bioentrepreneurship learning using comics. This dimension was developed into indicators of student understanding, student insight, and improvement of students' cognitive abilities.

The Biology concept used in this study is the sub concept of angiosperms because this concept is closely related to an entrepreneurial potential around SMAN 1 Susukan. The entrepreneurial potential of the area is cassava plants because there are many cassava plants in this region. In this study applying bioentrepreneurship learning by using comics is associated with entrepreneurship. This bioentrepreneurship comic is used in every applied learning activity such as classroom learning and assignments are given after learning such as making mind maps, product making, and business analysis.

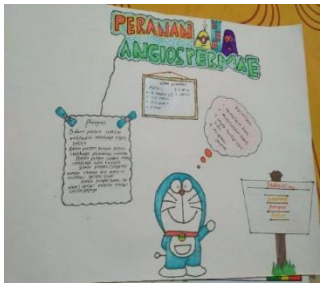
3. Results and Discussion

3.1 Students' Creativity

The observation of the creativity of the students in this study was obtained during bioentrepreneurship learning. The value of student creativity is obtained from the task of making mind maps and making products. The mind map assessment aspect includes three components, namely keywords, the relationship of the main branch with other branches, and design, while the product aspects are assessed namely product design, physical form, creative

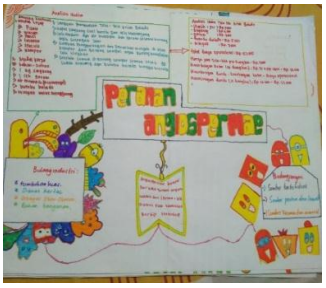
work, documentation, marketing, and business analysis. The following are the results of mind map making by group 1-6 presented in Figure 1.

Group 5



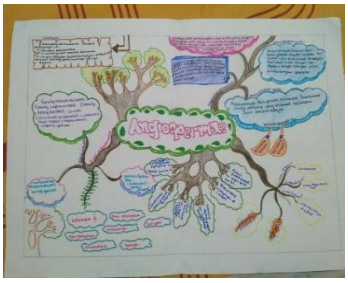
Group 4

Group 3



Group 2

Group 1

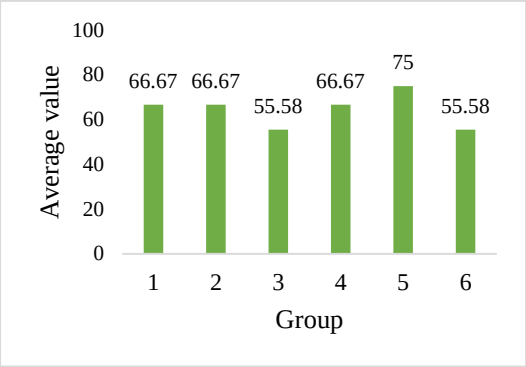


Group 6

Figure 1. Mind Map made by group 1-6

Figure 1 presents the results of students' mind maps products, which can be seen that their mind map are quite creative. The combination of content and design are quite interesting. A study of creativity for operational researchers by Vidal (2005) suggests that mind mapping is a visual and verbal device that is usually used in complex situations and the path to the creative process. The mind map is a definition of the creative part of complex ideas, thoughts, processes, objects, and so on. It is difficult to identify the authenticity of the authors in the technique so that the mind map assessment used is that of the students' creativity. Mind maps made by students will help to better understand the concepts learned. According to Susianna (2011), students make a mind map to facilitate student learning itself. The average value of creativity from the mind map products of each group can be seen in the graph 1.

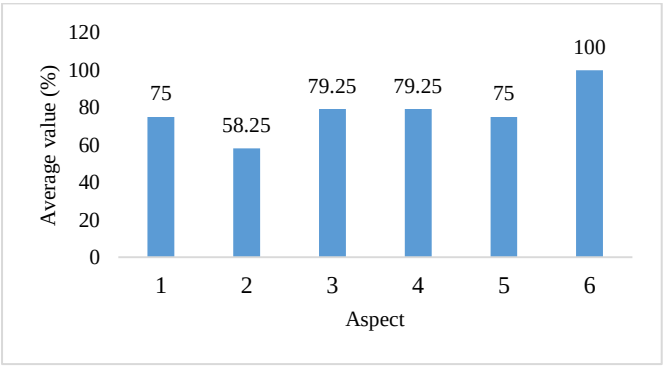
Based on Graphic 1, it was found that the percentage of the highest value of content in mind map group 5 was 75% with good criteria. Groups 1, 2 and 4 have the same percentage value of 66.67% with sufficient risk. Group 3 has a percentage of an average value of 68.75% with sufficient criteria. Group 6 has the lowest percentage average value of 55.58% with sufficient criteria.



Graphic 1. The Average Score of Mind Map Creativity

The other results of creativity are in working on product tasks that are aimed at and have entrepreneurial vision. Machin (2012) states that the measurement of student Intelligence Entrepreneurship can be done in learning biotechnology with the entrepreneurial vision which provides the task of making certain products. Product evaluation criteria include 1) ability to recognize opportunities from exploration activities 2) determine tools and materials needed 3) plan product manufacturing process 4) make products according to plan 5) innovation on products 6) make profit analysis 7) determine the best taste based on organoleptic tests , and 8) evaluate the advantages and disadvantages of the product that has been made.

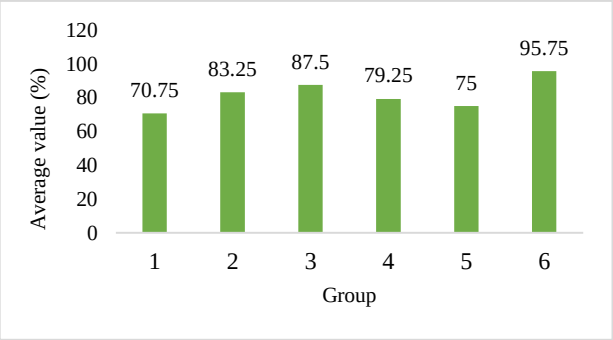
The results of the research are the task of making processed food products, where processed food products are limited to one main ingredient, which is cassava plants which are included in the angiosperm plant. The product making is done in the form of post-angiosperm learning assignments, namely after the second meeting. Before working on the assignment, each group was asked to make a product design. The results are presented in Graphic 2, and Graphic 3.



Graphic 2. The Average Value of Creativity on Product Making in Each Aspect

Graphic 2 presents the average value of creativity in the manufacture of processed food products from Manihot utilissima (cassava). The 6th aspect has the highest average

percentage value with an average percentage of 100% with very good criteria. The third and fourth aspects of the second highest order with the same average value of 79.25% with good criteria. The next sequence aspect is the 1st and 5th aspects with the percentage of the average value of 75% with good criteria. The lowest average value is in the second aspect with an average value of 58.25% with sufficient criteria. The average percentage of creativity assessment in making products for each group can be seen in Graphic 3 below:



Graphic 3. The Average Value of Creativity on Product Making of Each Group

Creativity in the manufacture of processed food products from one of the Angiospermae plants, namely Manihot Utilisima, was assessed from the six aspects for the six groups formed. The products made by each group are sequentially from groups 1-6, namely: 1) Cassava leaf chips, 2) Tela-tela kriuk Balado, 3) Cassava sticks, 4) Bakwan cassava leaves, 5) Cassava chips, and 6) balls- cassava ball. Based on Graphic 3, it is found that group 6 has the highest average value percentage with a value of 95.75%. Followed by group 3 with a percentage of the average value of 87.5%, group 2 having a percentage of an average value of 83.25%, group 4 having a percentage average value of 79.25%, group 5 having a percentage of average values of 75 %, and the lowest percentage average value is in group 1 with an average value of 70.75%.

The task of creative products in bioentrepreneurship learning is to shape students' creativity; this is because the activities that run during the manufacture of products encourage students to try to solve problems and solutions so that the products made are successful. Research on product assignments such as PJBL research provides opportunities for students to train and develop the quality of their ideas (Karina et al., 2014; Indriani et al., 2017). Also, the product of the manufacturing task encourages students to try to solve problems so students will have discussions in their respective groups. The discussion that will take place will encourage the formation of student creativity. Agommouh and Ndirika (2017) states that

classes that use assessment techniques, case studies or discussions, cooperative learning strategies, use questions, style of discussion in learning, use assessment in writing, and active dialogue are some of the methods and strategies of science teachers that can be used in science learning to improve students' entrepreneurial skills and shape creativity.

The results of the research in the form of students' creativity in making cassava processed products prove that the learning that has been applied in addition to forming Entrepreneur Intelligence (EI) of the students are also able to train creativity. Similar research was carried out by Fitri et al. (2014) who made a natta de lerri product on conventional biotechnology materials that use student worksheet. Bioentrepreneurship worksheets are theoretically feasible (obtained from expert validation) and empirical (observation of student activities) on implementation during learning and student response is good. Adinugraha's research (2017) makes learning media from used goods that can be traded. It is based on entrepreneurship education with ecopreneurship-based (environment-based) skills that can train student entrepreneurial skills. Kristanti et al. (2012) concluded that entrepreneurship learning devices are effectively applied to learning activities and can improve student entrepreneurial attitudes and interests. In contrast to this study, it produced two products, namely the food products mentioned above and the characteristics of bioentrepreneurship learning.

This modification of bioentrepreneurship learning can provide little change compared to ordinary learning. Micozzi and Micozzi (2014) argues that learning entrepreneurship requires a group or organization from learning entrepreneurship itself to have a heterogeneous formation to produce an excellent entrepreneurial team. Heterogenous here mean individual types in teams that vary from those who understand the concept well and who have high creativity as well.

It is proven empirically and theoretically based on the above explanation that the creativity of students learning by implementing bioenterepreneurship learning using comics in the sub concept of Angiosperms can be formed.

3.2 Cognitive Values of Students in Experimental Classes and Control Classes

The cognitive value of students is obtained from the results of the pre-test and post-test questions about Biology sub concepts of angiosperms. The difference in the increase in cognitive value between the experimental class and the control class was tested statistically, with a pre-trial test which included the normality test and the homogeneity test. This

prerequisite test consists of a normality test and a homogeneity test. Prerequisite tests are carried out as the initial stage in the statistical test before entering the hypothesis test. The prerequisite test results of cognitive abilities of the experimental class and control class students are explained in Tables 1 and 2.

Table 1. Normality Test for N-Gain Class Experiments and Control Classes

Data	**Class**	**Normality test (*Kolmogorov Smirnov*)**	
		Sig	**Notes**
N-gain	Experiment	0,200	Normal
	Control	0,200	Normal

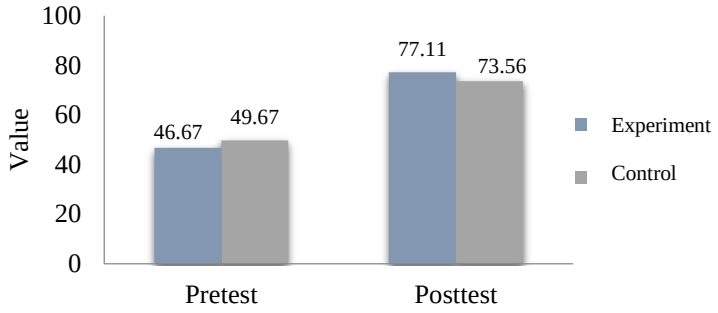
Table 1 presents the results of the N-Gain data normality test. Based on the results of the normality test of N-Gain data of the experimental class shows that data are normally distributed because the signification value is greater than 0.05 both in the control class and the experimental class. The normality test of the N-Gain data of control class and experiment results in the sig value. 0,200 so that the control class N-Gain data is normally distributed. It can be concluded, based on these data that, the experimental class N-Gain data and controls are normally distributed. Furthermore, the data were tested for homogeneity, the results of the homogeneity test are presented in Table 2.

Tabel 2. Homogeneity Test of *N-Gain* of Experiment and Control Classes

Data	**Class**	**Homogeneity Test**	
		Sig.	**Notes**
N-Gain	Experiment Control	0,902	Normal

The homogeneity test results for N-Gain data show homogeneous data because of the sig value. 0.902> 0.05. Based on the results of the prerequisite test, it is known that the N-Gain data is normally distributed and homogeneous. The N-Gain data prerequisite test results that indicate that the data are normally distributed and homogeneous.

After the preliminary test is done, the differences in the increase in cognitive values of students between the experimental class and the control class are tested by the t-test. The results of the study in the form of pre-test post-test scores between the experimental class and the control class can be seen in Graphic 4.



Graphic 4. The Score of Pretest-posttest of Experiment and Control Classes

Graphic 4 shows the cognitive abilities of students between the experimental class and the control class differently. A different test was carried out on the N-Gain data after performing the preliminary test, the Independent Sample T-Test parametric test. The results of different tests are presented in Table 3.

Table 3. The Result of T-Test to differ Experiment and Control Classes

Data	Different Test	Sig. (2-tailed)	Notes
N-Gain	*Independent sample T-Test*	0,016	Significantly Different

Table 3 shows the results of the t-test where the N-Gain experimental class and control class differ significantly. This study uses one-way research, so the results are more decisive, not only is there a difference between the two classes. The experimental class has better cognitive abilities than the control class so that the significance value and the value of α change to half of 0.05, the value α = 0.025. The significance value is 0.08 and still means that Ho is rejected and Ha is accepted. Based on these data it can be concluded that there are differences in the increase in cognitive values of students between the experimental class and the control class.

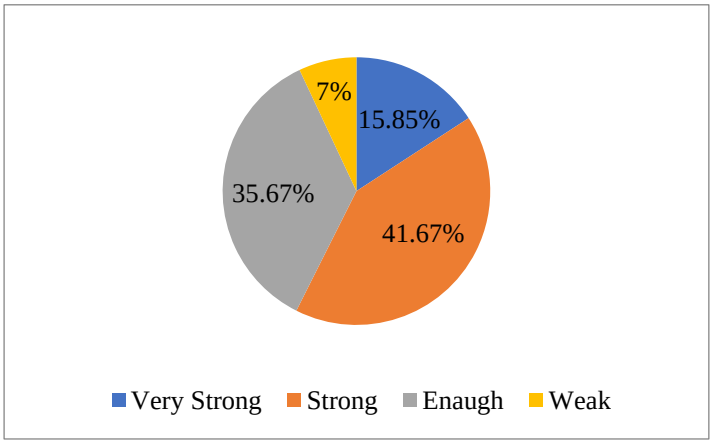
The results showed the achievement of cognitive abilities of students in the experimental class was better than the control class; this could prove the effectiveness of learning bioenterepreneurship using comics on the sub concept of the Angiosperms. The thinking process of students is formed when students are faced with a problem that is related to the real world or is contextual, besides that learning that is applied includes learning based on the environment and encouraging students to find their knowledge. By the research of Sukarsih (2016) which is learning to know, find, and live together, it is suitable for environment-based practical learning. Regarding the learning of bioenterepreneurship using comics in the sub concept of Angiospermae, Bula (2012) states that the learning process starts from learning to

know, tries to make products (learning to do), and makes products to be successful (learning to be) is effective learning.

Bioentrepreneurship learning using comics helps students to be independent and able to train students to get a way out of life's problems. This is by the character of entrepreneurship, namely the way to manage one's own business which can develop one's luck without the arrangement of other parties. Entrepreneurship is a factor and key to economic development in urban areas (Rahman & Islam, 2014). It is proven by the results of Alagboso's et al. (2015) study of the biotechnology process of entrepreneurship in Southeast Africa and Brazil due to the existence of environmental factors themselves. About the community, community empowerment strategies through ergo-entrepreneurship training are sufficient if they can do it (Suarsa & Sutajaya, 2015). Based on the description of the results of research on the cognitive value of students, Bioentrepreneurship learning using comics can be declared effective for improving students' cognitive abilities.

3.3 Student Response to Bioentrepreneurship Learning Using Comics

Students' responses to bioentrepreneurship learning using comics on the Angiosperm sub concept are known through student questionnaire instruments. The results of the questionnaire analysis are presented in Graphic 5.



Graphic 5. Student Responses to Bioentrepreneurship Learning Using Comics

Graphic 5 shows the percentage diagram of the student response questionnaire towards the application of bioentrepreneurship learning using comics to the sub-concept of the Angiosperm. The diagram illustrates that students' response to comic-based bioentrepreneurship learning combined with the Angiosperm sub concept has a strong and

very strong average. The strong and very strong response is 78.34%, the rest is the response of students with sufficient criteria and weak by 22.83%. The results obtained from students' responses showed that most or generally students gave a positive response to bioentrepreneurship learning using comics. Zhou and Xu (2012) argued that learning entrepreneurship could be used as a recommendation for improving living standards in the future.

Learning that is applied in this study can shape the personality of students. According to Siswadi (2013), there are internal factors, especially personality, and efforts are needed to increase it towards the interest in entrepreneurship of students. They are covering the need for achievement, locus of control, friendship with uncertainty and courage to take risks and confidence.

4. Conclusion

Student creativity in bioentrepreneurship learning using comics has increased at each meeting. The increase in the cognitive abilities of students in the experimental class who used the implementation of bioentrepreneurship learning using comics compared to classes that did not use the implementation of bioentrepreneurship learning using comics differed significantly. The cognitive value of students in the experimental class is higher than the cognitive value of students in the control class. Students' responses to comic-based bioentrepreneurship learning gave responses to strong and very strong criteria of 41.67% and 35.67% respectively; this meant that students were interested and loved the learning.

The increasing of the student creativity, student cognitive value and the strong student responses to comic-based bioentrepreneurship learning, shows that bioentrepreneurship learning using comics in the study proved effective.

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