



## The Effectiveness of Student Worksheet (Project-Based Learning) Based on the Values of Islamic Boarding School For The Biotechnology Subject to Train High School Students With Bio-entrepreneurship Skills

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**ABSTRACT:** This study aimed to describe the effectiveness of student worksheet with an approach of project-based learning for the conventional biotechnology subject to train high school students with bio-entrepreneurship skills. This study used instructional development method initiated by Fenrich through several steps: analysis, planning, designing, developing, implementation, evaluation, and revision. The experiment was conducted to 20 students at the twelfth grade in the Islamic Boarding School of A. Wahid Hasyim Jombang. The effectiveness of the project-based learning was 9.7% out of 100%. Students' response was 90.0% on the values of Islamic boarding school or *pesantren* which became the indicator of having the bio-entrepreneurship skills based on the summary of Adabul 'Alim Wal Muta'allim kitab (hard work, responsibility, tolerance /*tasamuh*). The completion of entrepreneurship project was 89.55%. These results showed that the student worksheet was effective.

### INTRODUCTION

Global competition in the 21<sup>th</sup> century is demanding. Indonesia has applied a curriculum which is considered excellent as a basis to have productive and competitive graduates in the international level. Meanwhile, the regulation of Ministry of Education Number 65 Year 2013 mentions that education platforms need to conduct learning and teaching process in interactive, inspiring, motivating, fun, and challenging ways to make the students productive and competitive. For example, they can create an innovation or idea.

Based on the data of Central Bureau of Statistics in February 2018, there were 6.87 million unemployed people. The highest number belongs to the graduates of vocational schools. Such phenomena also may happen to the graduates of senior high schools. According to Kristanti, *et.al* (2012), the number of unemployment in Indonesia is quite high because the high school graduates do not pursue higher education. Besides, the imbalanced number of employment opportunities makes the high school graduates difficult to find a job.

Teaching innovation needs to be accomplished to produce competitive and skilled graduates for workforce. Islamic boarding school or *pesantren* is special because it becomes an alternative education to balance the knowledge of spirituality and intelligence (Kamalia, 2015). Despite of these benefits, *pesantren* is still not free from the educational challenges.

The interview results show that the students in the High School of *Pesantren* A. Wahid Hasyim Jombang want to learn using the nature, environment, and society approach. Furthermore, such teaching process is expected to embed skills required in the workforce after graduating from the school. Based on the interview results with the Biology teachers for the twelfth grade, the teaching process especially in the Biology class has not involved the learning from *pesantren* and surrounding area.

In fact, the distance of High School of *Pesantren* A. Wahid Hasyim Tebuireng Jombang to the religious site of KH. Hasyim Asy'ari Sanctuary is only 20 meters. Many people come to the sacred place, but unfortunately it has not been explored as one of the teaching and learning activities in the school. Besides, the environment-based learning can give students life skills for entrepreneurship and interesting learning activities.

Life skill is one of bioentrepreneurship skills. The bioentrepreneurship is a process to produce a valuable product by using the concept and information about living things with creative and innovative implementation (Dewi, 2016).

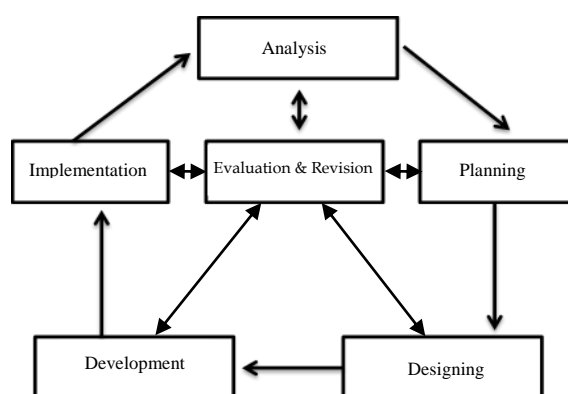
Munandar (2009) stated that Project-Based Learning may improve the way of thinking through students' participation in facing the real experience, so it may shape independent learners. Meanwhile, by developing the student worksheet, the project-based learning approach can be applied, and the student's involvement can result in attaining the goals of teaching and learning. These aspects are supported by Herdianawati, *et.al* (2013) who stated that learning strategies can be integrated to the student worksheet. Besides, biotechnology class is chosen because it is contextual, easy to find, implement, and explore according to the situation and opportunity in surrounding area where the students live. As a result, it is appropriate to give bioentrepreneurship training to the students.

As expected, there will be many more students with good life skills which make them easier to find a job. Moreover, *Pesantren* SMA A. Wahid Hasyim Tebuireng Jombang uses *Adabul 'Alim Wal Muta'allim Kitab* which applies five basic principles of Tebuireng as the values of *pesantren* education. Therefore, it is interesting if *pesantren* values can be embedded in the teaching and learning process. Thus, the education system using the student worksheet with project-based learning approach in the High School of *Pesantren* SMA A. Wahid Hasyim Tebuireng Jombang will train the students with life skills especially bioentrepreneurship skills. The embodiment of *pesantren* values in the student worksheet can be applied for biotechnology subject as a part of biology class.

Therefore, this study aimed at describing the effectiveness of the student worksheet with project-based learning approach for biotechnology subject to train students in the twelfth grade with bioentrepreneurship skills.

## METHODS

This study used the instructional development cycle by Fenrich (1997) that included six steps as following:



**Figure 1.** Stages of Student Worksheet Model for Biotechnology-Bioentrepreneurship with Project-Based Learning (Source is adapted from Fenrich, 1997)

- 1) **Analysis Stage**, this stage involved the analysis of curriculum, students, assignments, concept, and lesson goal plan.
- 2) **Planning Stage**, the student worksheet format was selected to develop the biotechnology lesson oriented to project-based learning through consultation to master teachers for the lesson.
- 3) **Planning Stage**, this stage was done by designing a student worksheet to improve bioentrepreneurship skills analyzed from the components, characteristics, and other supporting instruments of student worksheets.
- 4) **Development Stage**, the development of effective student worksheets was done as the following steps:
  - a) **Project Test Result Sheet**: This instrument was designed by the researcher to gain data of the students' understanding on the biotechnology principles and application in daily life. By using project-based learning worksheet, it was likely to train the students with bioentrepreneurship skills. The data varied from the project score, the calculation of Break Even Point (BEP), presentation and evaluation.
  - b) **Response Questionnaire Sheet**: This sheet was designed to produce three instruments according to the students' response towards the use of student sheets, the implementation of *pesantren* values as the basis or indicator of bio-entrepreneurship. As stated in the Adabul 'Alim Wal Muta'allim *Kitab*, there are hard work, responsibility, tolerance/*tasamuh*, and questionnaires for students' response towards entrepreneurship.
- 5) **Implementation Stage**, in this stage, the student worksheet was tested to 20 students at the twelfth grade in the High School of *Pesantren A. Wahid Hasyim Tebuireng*. They were grouped to be four groups and five members in each group. The experiment was conducted from November- December 2018.
- 6) **Evaluation and Revision Stage**, this stage involved the overall evaluation from stage 1 and 5 above. The experiment was conducted in the High School of *Pesantren A Wahid Hasyim Tebuireng Jombang*.

## RESULTS AND DISCUSSION

The effectiveness was measured from the project results and students' response using the instruments of project results and response questionnaires. Based on the data of the worksheets, the project-based learning approach was effective. The students in the High School of *Pesantren A Wahid Hasyim Tebuireng Jombang* were asked to conduct a project

using a student worksheet that directs students to produce fermented soybean in blocks or *tempe* as the first project. Then, the students needed to present and evaluate their masterpiece. Next, the students made Break Even Point (BEP) from the production and sales and reported them by filling out the student worksheet according to a scientific method and economic analysis. After that, the students presented their products and evaluated. The following was the data of project results by the students in groups.

**Table 1.** The Data of Product Production

Characteristics and Uniqueness of Project Results	Group			
	1	2	3	4
Successful Production	9 products	10 products	8 products	9 products
Product Quality (Organoleptic Results)	color (+++), aroma (+), texture (++), Taste (+++).	color (+++), aroma (+), texture (+++), Taste (+++)	color (++), aroma (+), texture (++), Taste (+++)	color (+++), aroma (+), texture (++), Taste (+++)
Successful Product Sales	9 products	10 products	7 products	8 products
BEP Production	Rp 25,000	Rp 25,000	Rp 25,000	Rp 25,000
BEP Price (per package)	Rp 5,000	Rp 5,000	Rp 5,000	Rp 5,000
BEP Profit/Loss	Rp 45,000	Rp 50,000	Rp 35,000	Rp 40,000
Profit/Loss Analysis	Profit 40%	Profit 50%	Profit 10%	Profit 30%
<i>Pesantren</i> Analysis	Surah Al	Surah An-Nur	Surah Fathir	Surah An-Nur
(Entrepreneurship motivation based on Islam)	Qashash Verse 77	Verse 37	Verse 29	Verse 37

The following was the results of *tempe* products:



A



B



C



D

**Figure 2.** Students' Project Results

Notes: A) *Tempe* Product of Group 1, B) *Tempe* Product of Group 2, C) *Tempe* Product of Group 3, D) *Tempe* Product of Group 4.

The data of project results from each group were presented in **Table 1** and **Table 2**. The data are obtained from groups as explained in **Table 2**. The percentage of aspects with the score of 93.7% was considered effective. The data of project results were as following:

**Table 2.** Project Scoring, Break Even Point (BEP) Calculation, Presentation and Evaluation

No	Assessed Aspects	Group Score				% Average
		1	2	3	4	
1	Accomplish all stages of the project as mentioned in the student worksheet 1	4	4	4	4	100%
2	Successful Production	4	4	3	4	93.8%
3	Production and evaluation of product	4	3	4	4	93.8%
4	Sales Success	4	4	3	3	87.5%
5	Profitable product	4	4	3	3	87.5%

No	Assessed Aspects	Group Score				% Average
		1	2	3	4	
6	Sales presentation and evaluation	4	4	4	4	100%
Percentase (%)						93.7%

The implementation of *pesantren* values in collaboration with the bio-entrepreneurship was also seen through the entrepreneur's characteristics. *Pesantren* values as the basis for bio-entrepreneurship were extracted from Adabul 'Alim Wal Muta'allim *Kitab*, and these included: 1) hard work, 2) responsibility, 3) tolerance/*tasamuh*. *Pesantren* values and bio-entrepreneurship indicators like *pesantren* values were merged and selected.

**Table 3.** *Pesantren* values as the basis of bio-entrepreneurship from Adabul 'Alim Wal Muta'allim *Kitab*

No.	<i>Pesantren</i> values as the indicators of bioentrepreneurship extracted from Adabul 'Alim Wal Muta'allim <i>Kitab</i>	Percentage of Students' Response (%)		Assessment Category
		Yes	No	
1.	Students are encouraged to work hard in doing business in a group	90%	10%	Quite Satisfying
2.	Students are encouraged to be responsible to their business because they will face many challenges	85%	15%	Quite Satisfying
3.	Students are willing to receive comments about their business since they have tolerance/ <i>tasamuh</i> for better business in the future	95%	5%	Moderately Satisfying
Total percentage of students' response		90%		Quite Satisfying

The total percentage of students' response towards *pesantren* values implemented was 90% with quite satisfying category. Meanwhile, the entrepreneurship skills were obtained from the questionnaires for the entrepreneurship. The results of questionnaires could be seen in **Table 4** with the performance of 89.5%. The results were gained from 10 aspects of entrepreneurship assessment with a range score of 80-100%. The data of entrepreneurship were illustrated in the following table.

**Table 4.** Questionnaire Results of Students' Response towards Entrepreneurship

No.	Assessed Aspects	Percentage of Students' Response		Assessment Category
		Yes	No	
1.	Students are encouraged to run a business because they find successful entrepreneur	90%	10%	quite satisfying
2.	Students are interested in doing business because they face challenges	80%	15%	quite satisfying
3.	Students want to run a business because they want better future	85%	20%	moderately satisfying
4.	Students are interested to start their business because there is no similar business in the area where they live	80%	20%	moderately satisfying
5.	Students feel happy if they can successfully run their bussiness	100%	-	quite satisfying
6.	Students are not afraid of failure to start a bussiness	90%	10%	quite satisfying
7.	Students feel confident to run a business	85%	15%	quite satisfying

No.	Assessed Aspects	Percentage of Students' Response		Assessment Category
		Yes	No	
8.	Students are interested in running a business because they can create better job opportunity than looking for other jobs	95%	5%	quite satisfying
9.	Students run business based on the guidelines of student worksheets	100%	-	quite satisfying
10.	Students plan to continue their business	90%	10%	quite satisfying
The eligibility of worksheet according to students' response		89.5%		quite satisfying

This student worksheet was designed to guide the students to have bioentrepreneurship skills which were assessed based on the project performance (Table 1). These skills were influenced by six aspects which involved the ability to: (1) follow the stages in the student worksheet, 2) to have certain success level of products, 3) to present and evaluate the products, 4) to succeed product sales, 5) to produce profitable products, and 6) to present and evaluate sales. In terms of the ability to present and evaluate sales, all groups should fulfilled the indicators from the aspects assessed, such as being able to: 1) present accurate data as they have obtained, 2) to answer questions, and 3) to find the products' novelty and flaws.

Like what Kubiato and Vaculoca (2010) mentioned, teaching and learning process with project-based learning approach aim to develop resource for finding information and evaluating the results for the project completion. A project-based learning model focuses on the students and uses the planning to direct them to a particular path, and it is possible to scrutinize a topic more deeply (Grant, 2002).

The student worksheet is effective to guide students as mentioned by Sari *et.al* (2013). It directs the learning process as an alternative tool and makes students accomplish learning activities. Moreover, it facilitates students with easy guide to learn and understand the lesson (Hidayati *et al.*, 2012).

In terms of product production, some of the groups failed to produce *tempe*. According to the data, the groups have different results. For example, out of 10 products made, Group 1 and 4 had completed to produce 9 products. Group 2 had produced 10 products while Group 3 had produced 8 products. The instrument cleanliness for laboratory experiment may influence the production success since each group uses different instruments with relative cleanliness.

In relation with the number of products produced during the experiment, sales success and product profits also influenced the results. Based on the data obtained, the average percentage from these aspects was 87.3%. These aspects were determined by the number of products sold and their profits. Group 1 had profits of Rp. 20.000. Group 2 obtained a profit of Rp. 25.000. Group 3 had Rp. 10.000 for the product profit. Group 4 earned a profit of Rp. 15.000. Based on the profits they have made, Group 2 had the biggest profit among others. How they gained profit from the products was a way to develop students' interest and tendency to do the same thing as they were successful to sell their products and gained profits. This finding was in line with Sugiarto, *et.al* (2015) who stated that entrepreneurship training may give students bravery and ability to try the best, and it influences the students' interest.

After the calculation of the profits, the students had to present and evaluate their products. Three indicators for the assessment included ability to: (1) present their products

based on the data collected, (2) answer questions, and (3) find novelty and flaws of their products. All groups had accomplished this stage with very satisfying performance. Presenting data in the student worksheet which emphasized on the project-based learning and bio-entrepreneurship, students were encouraged to be an excellent and independent communicator. As stated by Aprilia (2014), a project is a complex task in which students are the subjects to find and solve a problem, investigate, work independently, and produce the real product. Besides, the students build their own knowledge in active learning process; interact with the environment in independent and collaborative learning with their team. Meanwhile, the teacher's guide them to produce the product (Thomas, 2000).

Biology subject in which biotechnology lesson was aimed to train students with bio-entrepreneurship could use the project-based learning model. This learning model refers to the constructivism embedded in the students' activities to build their own knowledge in a meaningful way through the real experience (Siwa *et.al*, 2013).

Besides, the researcher also found the data of *pesantren* values which were collaborated with bio-entrepreneurship through the entrepreneur characteristics. The entrepreneur characteristics included: 1) independency, 2) hard work, 3) willingness to be criticized, 4) responsibility, 5) risk-taker (either profit or loss). Meanwhile, *pesantren* values as the basis of the bio-entrepreneurship are retrieved from *Adabul 'Alim Wal Muta'allim Kitab*. These included: 1) hard work, 2) responsibility, and 3) tolerance/*tasamuh*. All these values of entrepreneur's characteristics and *pesantren* education with the same goals were selected. After all, the collaborated values had resulted in three ideas. First, students were encouraged to work hard by running a business in a group. Second, they were encouraged to be responsible to their business since they will face many more challenges ahead. Third, students were willing to be criticized for the better business so that they tolerate/*tasamuh* the comments as a part of growing their business. The total percentage of students' response was 90% considered quite satisfying.

Based on the students' response on the entrepreneurship, their interest in entrepreneurship was 89.5% which was quite satisfying. Out of ten aspects scored to determine the students' interest in entrepreneurship, the students gave positive response to nine aspects with a score range of 80-100%. Students' interests to ran a successful business and accomplish a business as explained in the student worksheet were the aspects with the highest score. Overall, after the students participated in the bio-entrepreneurship training, their interest in entrepreneurship was positive with 89.5% score considered quite satisfying.

However, the students' life skills, critical thinking, and entrepreneurship skills like bioentrepreneurship should be fostered (Putri, 2017). Even though the education competence did not mention that students should master the bioentrepreneurship, education was the way to execute cultures that follow the era and change overtime to create betterment. Therefore, bio-entrepreneurship training should be conducted so that students can explore, plan, produce, communicate or market, and reflect a product.

The students' response needed to be assessed to identify their interest in entrepreneurship. It was because self-interest may result in better performance compared to compulsion. Based on Suharyat (2009), interest is passion to do something without being compelled. Simply said, interest was self-acceptance to be connected with something outside. The stronger the connection was, the bigger the interest was. Entrepreneurship training also gives someone confidence and bravery to try the best, and, thus, it influences their interest in entrepreneurship (Sugiarto *et al.*, 2015).

Interests in the entrepreneurship could be improved by training students with entrepreneurship skills. The training is a way to explain, educate, and overview the entrepreneurship so that students can develop a business (Putra, 2012). This was in

accordance with the cognitivism theory which mentions that learning can shape a permanent experience and knowledge as well as behaviour which is exerted through learning in a real context (Jensen, 2007).

Despite learning in a real world, the training could teach students how to cooperate, be responsible, and tolerate the tasks. This finding has the same idea of theory by Vygotsky (1980) who initiated the Zone of Proximal Development. The theory explains that students can solve problems independently by cooperating with colleagues and being supervised by adults (Taylor, 1993). Based on the data obtained, the student worksheet developed in this study could be considered effective.

## CONCLUSION

In conclusion, the student worksheet emphasizing on the project-based learning approach for the biotechnology lesson was proper to be utilized. The effectiveness of the student worksheet could be seen from the students' project performance which was 93.7. Second, the implemented *pasantren* values as the indicator of bio-entrepreneurship values according to Adabul 'Alim Wal Muta'allim *Kitab* was amounted to the score of 90%. Lastly, the students' interest in entrepreneurship was measured from the completion of their project which was 89.5%. In other words, the student worksheet was considered effective.

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