# THE IMPLEMENTATION OF ACTIVITY SHEET BASED ON PROJECT-BASED LEARNING ON BIOTECHNOLOGY MATERIAL TO TRAIN BIOENTREPRENEURSHIP SKILLS FOR FIRST GRADE HIGH SCHOOL STUDENTS

## Penerapan Lembar Kegiatan Peserta Didik Project Based Learning Materi Bioteknologi untuk Melatihkan Keterampilan Bioentrepreneurship pada Siswa Kelas X SMA

**Alicia Oktavinda**

Biology Education, Faculty of Mathematics and Natural Sciences, State University of Surabaya

*E-mail*: aliciaoktavinda.20057@mhs.unesa.ac.id

**Winarsih**

Biology Education, Faculty of Mathematics and Natural Sciences, State University of Surabaya

*E-mail*: winarsih@unesa.ac.id

## Abstract

The Merdeka Curriculum is implemented to develop 21st century skills, one of which is entrepreneurial skills. The field of biology study that is integrated with the concept of entrepreneurship is called bioentrepreneurship. Bioentrepreneurship skills can be trained through implementing the Project-Based Learning (PjBL) learning strategy using the help of student activity sheets (LKPD). This research aims to describe 1) the implementation of learning, 2) students' bioentrepreneurship skills, and 3) students' responses to the implementation of Project-Based Learning LKPD on biotechnology material. This research was conducted at SMAN 2 Lamongan in class. The parameters used to collect data include 1) implementation of learning, 2) bioentrepreneurship skills, 3) student response. The research data were analyzed using quantitative descriptive analysis methods. The results showed that 1) the implementation of learning carried out by teachers was very good, amounting to 95.8%, 2) 94.5% of students implemented bioentrepreneurship skills very well and achieved indicator completion with details of the percentage increase per indicator exploring, planning, producing, communicating, and reflecting respectively at 51.4%, 52.7%, 54.2%, 38.2%, and 42%, 3) student responses to LKPD were 95.73% or very positive. Thus, it can be concluded that the application of PjBL LKPD in biotechnology material can significantly train bioentrepreneurship skills in class X high school students. Students are expected to demonstrate strong learning motivation, engage in active learning, and have bioentrepreneur skills that suit their current and future needs.

**Keywords:** implementation of activity sheets, project-based learning, bioentrepreneurship skills, biotechnology material.

## Abstrak

*Kurikulum Merdeka diberlakukan untuk mengembangkan keterampilan abad 21, salah satunya keterampilan kewirausahaan. Bidang studi Biologi yang diintegrasikan dengan konsep kewirausahaan disebut dengan Bioentrepreneurship. Keterampilan Bioentrepreneurship dapat dilatih melalui penerapan strategi pembelajaran Project Based Learning (PjBL) menggunakan bantuan lembar kegiatan peserta didik (LKPD). Penelitian ini bertujuan untuk mendeskripsikan 1) keterlaksanaan pembelajaran, 2) keterampilan Bioentrepreneurship siswa, dan 3) respon siswa dari penerapan LKPD berbasis PjBL pada materi bioteknologi. Penelitian ini dilakukan di SMAN 2 Lamongan pada kelas X yang diikuti 72 siswa. Desain penelitian one group pretest-posttest design dan memakai metode tes, observasi, dan angket serta analisis menggunakan analisis deskriptif kuantitatif. Parameter yang diukur adalah 1) keterlaksanaan pembelajaran, 2) keterampilan Bioentrepreneurship, 3) respon siswa. Data hasil penelitian dianalisis dengan metode analisis deskriptif kuantitatif. Hasil penelitian menunjukkan 1) keterlaksanaan pembelajaran yang dilakukan oleh guru sangat baik, sebesar 95,8%, 2) 94,5% siswa telah melaksanakan keterampilan Bioentrepreneurship dengan sangat baik dan mencapai ketuntasan indikator dengan rincian persentase peningkatan per indikator exploring, planning, producing, communicating, dan reflecting secara berurutan sebesar 51,4%, 52,7%, 54,2%, 38,2%, dan 42%, 3) respon siswa terhadap LKPD sebesar 95,73% atau sangat positif. Kesimpulan penelitian menunjukkan penerapan LKPD PjBL dalam materi bioteknologi dapat melatihkan keterampilan Bioentrepreneurship pada siswa kelas X SMA secara signifikan. Siswa diharapkan menunjukkan motivasi belajar yang kuat, terlibat dalam*

*pembelajaran aktif, dan memiliki keterampilan bioentrepreneur yang sesuai dengan kebutuhannya saat ini dan nanti.*
**Kata Kunci:** *Penerapan LKPD, project based learning, bioentrepreneurship, materi bioteknologi.*

## INTRODUCTION

The Merdeka Curriculum is implemented to develop 21st century skills. 21st century skills are very important to increase the capacity of human resources in Indonesia, especially in education. Education is required to equip students to be able to compete in all fields and compete on an international scale (Afwan, 2020). Entrepreneurial skills are one of the skills needed to face the challenges of the 21st century.

So far, entrepreneurship skills have not been trained much in the biology learning process in high school, this is proven based on interviews conducted with several high school graduates. In the biology field of study, there is a lot of material that can be integrated with the concept of entrepreneurship. The combination of the concept of entrepreneurship with the biology field of study is usually called bioentrepreneurship (Prihatiningrum, 2019). Bioentrepreneurship skills themselves are defined as a skill that has indicators: 1) being able to recognize business opportunities for a product (exploring), 2) designing the product manufacturing process (planning), 3) carrying out the production process according to design and being able to innovate the product (producing), 4) being able to communicate the product (communicating), and 5) being able to evaluate the advantages and disadvantages of the product (reflecting) (adapted from Machin, 2012). Bioentrepreneurship skills can be trained through implementing learning strategies where students are the center of the learning to build and apply concepts to produce a product; this is suitable with the project-based learning model, or Project Based Learning (PjBL) (Damayanti, 2021).

Project-Based Learning is a learning model that focuses on students as the center, where students are involved in a collaborative project to create a product. The syntax in project-based learning (PjBL) includes: 1) Basic questions (Question), 2) Project planning design (Plan), 3) Preparation of project schedules (Schedule), 4) Monitoring project implementation (Monitoring), 5) Project presentation (Assess), and 6) Reflection and evaluation (Evaluating) (Afriana, 2016). PjBL learning involves students in preparing and implementing projects so that students can find solutions using concepts or scientific disciplines (Purnomo et al., 2015). In this way, students are expected to be able to explore by making discoveries with bioentrepreneurship skills and produce innovative products.

PjBL-based learning to train bioentrepreneurship can be applied in learning using the help of student activity sheets (LKPD) (Fitri et al., 2014). Based on the results of field studies and interviews with class X biology teachers at SMAN 2 Lamongan, it can be seen that during the biology learning process, they still use activity sheets that only contain basic information and questions related to the concept of biotechnology, but have not been able to train bioentrepreneurship skills.

The selection of material is based on suitability with the Project Based Learning (PjBL) learning model, namely biotechnology material. Biotechnology material, especially in conventional biotechnology in the food sector, has the aim of developing a food ingredient by increasing its nutritional value and taste so that it can increase the economic value of the food ingredient (Rompegading, 2023). This is in line with the PjBL learning model, which at the end of the learning creates real results in the form of products that have been studied and developed based on problem topics (Fathurrohman, 2016). The biotechnology material and PjBL learning model focus on product development with the aim of increasing the value of the product, so it can be said that the PjBL learning model can be used in biotechnology material to improve entrepreneurship skills.

One of the activity sheets that has been developed about biotechnology is the activity sheet developed by Amalia (2023), which produces Project Based Learning based activity sheets to train bioentrepreneurship that are suitable for use in learning activities with a validation result of 3.7 on activity sheet 1 and activity sheet 2 with a very worthy category. The level of validation obtained is reviewed based on several criteria, such as the identity aspect of the activity sheet, technical requirements in the form of language construction, the contents of the activity sheet, and the characteristics of the entrepreneur. This activity sheet has not yet reached the trial stage directly with students due to the constraints of the Covid-19 pandemic. Here the researchers developed a PjBL-based teaching module and included indicators of bioentrepreneurship skills; apart from that, the teaching module was developed in accordance with the current Merdeka curriculum. Next, the researchers developed a bioentrepreneurship skills test instrument consisting of a pretest and posttest to measure cognitive learning. outcomes as well as a student response questionnaire sheet. Based on the explanation that has been presented, the researcher wants to conduct research with the title:

656

"The Implementation of Activity Sheets based on Project-Based Learning on Biotechnology Material to Train Bioentrepreneurship Skills for First Grade High School Students."

The researcher's goals are to describe the implementation of learning, bioentrepreneurship skills, and students' responses to the application of Project Based Learning (PjBL) activity sheets on biotechnology material. Students are expected to demonstrate strong learning motivation, engage in active learning, and have bioentrepreneur skills that suit their current and future needs.

## METHOD

This type of research is the implementation of learning tools using a one-group pretest-posttest design. This research consists of three stages: preparation, implementation, and data analysis. The results of this research obtained the implementation of learning, the results of bioentrepreneurship skills, and student responses.

This research was conducted by collecting data at SMA Negeri 2 Lamongan in the first class of the second semester in May-June 2024. This research used as subjects class X students who had not received biotechnology material in two classes with a total of 72 students.

The research data were analyzed using quantitative descriptive analysis techniques. The implementation of the learning process can be said to be good if the percentage is 61-80%. Bioentrepreneurship skills can be said to be complete if analysis of the pre-test and post-test results through the n-gain test shows an increase and a score exceeding the minimum completion criteria, namely ≥80; student responses can be said to be positive if they get a percentage ≥75%.

## RESULTS AND DISCUSSION

The results obtained in this study are explained as follows:

### Implementation of Learning Activities

Implementation observations were carried out by the class X biology teacher at SMAN 2 Lamongan. Data on the implementation of learning management carried out in each class at the first meeting can be seen in the table 1 and 2:

Table 1. Observation results of learning implementation using PjBL-based activity sheet 1 at the first meeting

| No. | Aspect | X 8 | X 9 | Average | Category |
|-----|--------|-----|-----|---------|----------|
| 1. | Introduction | 83,3 | 100 | 91,6 | VP |
|  | a.  Opening |  |  |  |  |
|  | b.  Motivation and appreciation |  |  |  |  |
|  | c.  *Pre-test* |  |  |  |  |
| 2. | Core Activities |  |  |  |  |
|  | a.  Question | 100 | 100 | 100 | VP |
|  | b.  Plan | 100 | 100 | 100 | VP |
|  | c.  Schedule | 100 | 100 | 100 | VP |
|  | d.  Monitoring | 100 | 100 | 100 | VP |
| 3. | Closing |  |  |  |  |
|  | Summarize and conclude the lesson. | 100 | 100 | 100 | VP |
|  | Total |  |  |  | 591,6 |
|  | Average |  |  |  | 98,6 |
|  | Category |  |  |  | VP |

Note:

VP = Very Practical

Table 2. Observation results of learning implementation using PjBL-based LKPD 1 at the second meeting

| No. | Aspect | X 8 | X 9 | Average | Category |
|-----|--------|-----|-----|---------|----------|
| 1. | Introduction | 100 | 100 | 100 | VP |
|  | a.  Opening |  |  |  |  |
|  | b.  Motivation and appreciation |  |  |  |  |
| 2. | Core Activities |  |  |  |  |
|  | a.  Assess | 100 | 100 | 100 | VP |
|  | b.  Evaluating | 100 | 66,7 | 83,3 | VP |
| 3. | Closing |  |  |  |  |
|  | Summarize and conclude the lesson. | 100 | 100 | 100 | VP |
|  | Total |  |  |  | 383,3 |
|  | Average |  |  |  | 95,8 |
|  | Category |  |  |  | VP |

Note:

VP = Very Practical

Based on Table 1, it can be seen that the overall implementation of learning activities using Project Based

657

Learning activity sheets at the first meeting were in the very practical category. First, in the introductory part of both classes, an average of 91.6% was obtained, which can be categorized as very practical. This value proves that the teacher has explained the objectives of the learning as well as prepared students before entering the core of the learning. Furthermore, the core learning part of the Project Based Learning stage from both classes obtained an average of 100%, which can be categorized as practical. This score shows that the teacher can guide and direct students during the basic question stage, design product planning, prepare a manufacturing schedule, monitor project progress, as well as carry out activities in activity sheet 1. Finally, in the closing section, all classes obtained an average of 100%, which can be categorized as very practical. Obtaining this score shows that the teacher can guide students in making conclusion sentences correctly. The overall average aspect of both classes is 98.6%, which can be categorized as very practical.

Based on Table 2, it can be seen that the overall implementation of learning activities using Project Based Learning activity sheets at the second meeting was in the very practical category. Firstly, in the introductory part of both classes, an average of 100% was obtained, which can be categorized as very practical. This value proves that the teacher has explained the purpose of learning, as well as prepared students before learning. Furthermore, the core learning part of the Project Based Learning stage from both classes obtained an average of 91.65%, which can be categorized as very practical. This value shows that the teacher can guide and direct students when assessing student success, evaluating student experience, as well as carrying out activities in activity sheet 2. Finally, in the closing section, all classes obtained an average of 100%, which can be categorized as very practical. Obtaining this score shows that the teacher can guide students in making conclusion sentences correctly. The overall average aspect of both classes is 95.8%, which can be categorized as very practical. These aspects were implemented well during the first and second learning meetings. This implementation can be seen from the average percentage given by observers to each class, which has very good criteria.

Based on the analysis of learning implementation, it can be stated that the teacher has implemented the learning process using the Project Based Learning learning model very well. Based on Tables 1 and 2, it shows the results of the implementation of the Project Based Learning learning process in classes X 8 and X 9. with an average percentage of 97.2% and can be

categorized as very practical. The implementation of learning using the PjBL learning model cannot be separated from the teacher's ability to carry out learning activities, high student involvement, and achieving learning goals. According to Sugihartono (in Kurniawati, 2018), the implementation of learning can occur if there is reciprocity between teachers and students and learning media to achieve learning goals. Based on the description and discussion of the data above, it can be said that overall teachers can carry out the learning process by implementing Project Based Learning-based LKPD well.

**Bioentrepreneurship Skills**

Observation of students' bioentrepreneurship skills activities was observed by 4 observers, namely students majoring in Biology, State University of Surabaya. Data regarding the acquisition of student's Bioentrepreneurship skills during learning process, the average percentage from classes X 8 and X 9 is shown in the Table 3:

Table 3. The Results of Students' Bioentrepreneurship Skills

| No. | Bioentrepreneurship Skills | X 8 (%) | X 9 (%) | Average (%) | Category |
|-----|----------------------------|---------|---------|-------------|----------|
| 1. | Exploring | 93 | 95 | 94 | E |
| 2. | Planning | 97 | 97 | 97 | E |
| 3. | Producing | 94 | 92 | 93 | E |
| 4. | Communicating | 96 | 90 | 93 | E |
| 5. | Reflecting | 96 | 97 | 96,5 | E |
| | Total | 477 | 472 | 474,5 | E |
| | Average | 95 | 94 | 94,5 | E |
| | Category | E | E | E | E |

Note:

E = Excellent

Based on the results presented in Table 3, it is known that the percentage of student activity in each aspect observed achieved a score that can be categorized as excellent in terms of the results of observations made by the four observers during the learning activities. The exploring aspect obtained an average of 94%, where students were trained to observe and analyze problems in the surrounding environment and then formulate an idea to help overcome these problems. Then the planning activity obtained 97%, where students were trained to design product plans such as determining processed products, determining manufacturing methods, determining cost budgets as well as preparing

*Oktavinda, Alicia & Winarsih: Penerapan LKPD PjBL Materi Bioteknologi*

implementation schedules. Then producing activities obtained an average of 93% where students were trained to produce products by adding or replacing materials as a form of product innovation. Then the communicating activity obtained an average of 93%, where students were trained to present reports and product results that had been made while assessing the results of other group's products. Then the reflecting activity obtained an average of 96.5%, where students were trained to evaluate products that had been made by analyzing the advantages and disadvantages of the product. Overall, observations of bioentrepreneurship skills from both classes received a very good category with an average percentage of 94.5%.

The data from the indicator completion analysis Table 4 was obtained from the pre-test and post-test. Through the table, it is known that the average percentage of completion of the post-test indicators for class X 8 is 91.3%, with an increase of 44.6% from the average percentage of completeness of the pre-test indicator of 46.7%. The same thing also happened to the completeness of the indicators in class X 9, which experienced an increase in the average percentage of the post-test of 91.6%, an increase of 49.1% from the average percentage of completeness of the pre-test indicators, namely 42.5%.

Table 4. Results of Analysis of Completeness of Students' Pre-test and Post-test Indicators

| No. | Indicator | X 8 | | X 9 | |
|---|---|---|---|---|---|
| | | *Pre* | *Post* | *Pre* | *Post* |
| 1. | Exploring | 41,7% | 94,4% | 43,1% | 93,1% |
| 2. | Planning | 44,4% | 95,8% | 40,3% | 94,4% |
| 3. | Producing | 36,1% | 86,1% | 33,3% | 91,7% |
| 4. | Communicating | 61,1% | 94,4% | 45,8% | 88,9% |
| 5. | Reflecting | 50,0% | 90,7% | 50,0% | 89,8% |
| | Persentage of indicator completion | 46,7% | 92,3% | 42,5% | 91,6% |
| | Category | L | E | L | E |

Note: L = Low E = Excellent

Apart from the completeness of the pre-test and post-test results, which are described in Table 4, the increase in learning outcomes can also be seen through the percentage results for each indicator of Bioentrepreneurship skills which are described in Figure 1.
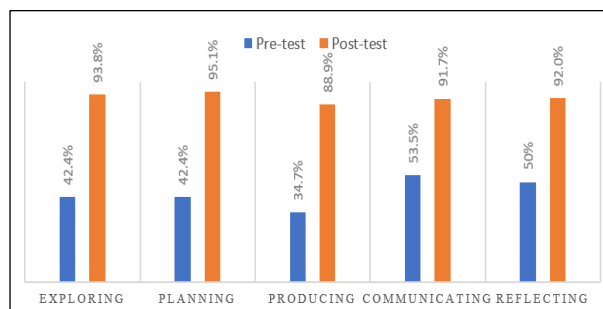


Figure 1. Recapitulation of Complete Results for Each Bioentrepreneurship Indicator

Based on Figure 1, the pre-test results obtained for each bioentrepreneurship skill indicator are recognizing business opportunities for a product (exploring), designing a product manufacturing process (planning), carrying out the production process according to the design and innovating the product (producing), communicating the product (communicating), and evaluating the product's advantages and disadvantages (reflecting), respectively obtained results of a completeness percentage of 42.4%, 42.4%, 34.7%, 53.5%, and 50%. The overall average indicator of bioentrepreneurship skills based on pre-test results is 44.6%. Meanwhile, the post-test results for each indicator of bioentrepreneurship skills obtained a completion percentage of 93.8%, 95.1%, 88.9%, 91.7%, and 92%. Based on the post-test that has been carried out, the overall bioentrepreneurship skill indicators get an average of 92.3%. Overall, there is an increase in students' bioentrepreneurship skills in each indicator and can be seen based on the average percentage increase in each indicator of bioentrepreneurship skills.

To determine the magnitude of the increase in student's Bioentrepreneurship skills scores, Pre-test and Post-test were given at the beginning and end of learning using activity sheets PjBL-based, then a gain score analysis was carried out on student's Pre-test and Post-test scores. It can be said that there has been an increase in the average pre-test and post-test results. From Table 5 it can be said that there has been an increase in the average pre-test and post-test results. These differences were analyzed for improvement using N-gain, the <g> value obtained in class X 8 with an average of 0.88 and included in the high N-gain category, for class high gain. The improvement that occurred was shown by the post-test score obtained after implementing the learning process using PjBL-based activity sheets which was higher than the pre-test score obtained at the start of learning. In accordance with the school's minimum completeness criteria (KKM), which is ≥ 80, it can be stated that 100% of the KKM has been met from both

classes, this can be seen from the post-test results. This proves that implementing a learning process using Project Based Learning-based activity sheets can train student's Bioentrepreneurship skills.

Table 5. Average Results of n-gain Analysis Scores in Classes X 8 and X 9

| Class | Minimum Completeness Criteria | Pre-test | Post-test | Gain Score | Category |
|-------|-------------------------------|----------|-----------|------------|----------|
| X 8 | 80 | 48,1 | 92,8 | 0,88 | High |
| X 9 | 80 | 44,2 | 91,4 | 0,85 | High |
| Average | | | | 0,87 | High |

Overall, based on Table 5, post-test completeness was 100% and the average N-gain score was 0.87, which is classified as high. Based on Figure 1, the post-test learning results for each indicator of bioentrepreneurship skills got an average of 92.3% and increased compared to the pre-test which only got an average of 44.6%, so the increase shows that students' Bioentrepreneurship skills have been trained after using Project Based Learning-based LKPD on biotechnology material.

**Student Response**

Based on the questionnaire filled out by students after learning, students' responses to learning using PjBL-based activity sheets can be obtained. The student response questionnaire included 15 questions with the answer options "Yes" or "No." Table 6 is a recapitulation of data results from filling out response questionnaires given to students regarding the ongoing learning process.

Table 6. Results of Observation of Students' Bioentrepreneurship Skills

| No. | Statements | Percentage | | Average |
|-----|-----------|------------|------|---------|
| | | X 8 | X 9 | |
| Presentation Aspect | | | | |
| 1. | The learning objectives in this activity sheet are written clearly. | 100 | 100 | 100 |
| 2. | The time allocated is sufficient to work on the activity sheet. | 97,2 | 100 | 98,6 |
| 3. | Instructions for working on activity sheets are easy to understand. | 100 | 100 | 100 |
| 4. | The activity steps in this activity sheet are easy to carry out. | 86,1 | 83,3 | 84,7 |
| 5. | The practice of the "question" step is easy to do. | 88,9 | 88,9 | 88,9 |
| 6. | The practice of the "Plan" step is easy to do. | 86,1 | 100 | 93,05 |
| 7. | The practice of the "schedule" step is easy to do. | 94,4 | 97,2 | 95,8 |
| 8. | The practice of the "monitoring" step is easy to do. | 94,4 | 100 | 97,2 |
| 9. | The practice of the "assess" step is easy to do. | 97,2 | 100 | 98,6 |
| 10. | The practice of the "evaluating" step is easy to do. | 97,2 | 100 | 98,6 |
| 11. | This activity sheet helps students understand concepts about the subjectmatter. | 100 | 91,7 | 95,85 |
| Display Aspect | | | | |
| 12. | The appearance of this activity sheet is interesting. | 94,4 | 97,2 | 95,8 |
| 13. | The pictures on this activity sheet are quite clear and increase understanding. | 100 | 94,4 | 97,2 |
| 14. | The language used in this LKPD is easy to understand. | 97,2 | 94,4 | 95,8 |
| 15. | Project-based learning with these activity sheets is more fun. | 100 | 91,7 | 95,85 |
| Total | | | | 1.435,95 |
| Average | | | | 95,73 |
| Category | | | | Very Positive |

Based on student responses in Table 5, the results of student responses regarding the application of learning show that of the 72 students in classes X 8 and X 9, the average percentage of students answering the positive response "yes" of 95.73% is included in the very positive category. The response given by students shows the response when the Project Based Learning-based activity sheet is applied. This shows that students give a very positive response to learning activities using Project Based Learning-based activity sheets on biotechnology material. This is due to the quality of implementation of doing project activities with their respective groups so that students are able to solve existing problems while training students bioentrepreneurship skills.

Based on Table 6 regarding student responses to learning using Project Based Learning activity sheets. The average percentage of student responses is positive.

660

This is due to the quality of implementation of practicum activities with their respective groups. This makes students able to solve existing problems while practicing students's bioentrepreneurship skills.

Based on Table 6, it shows that both classes have an average percentage of 95.73% with a category that is classified as very positive. Apart from that, there were several statement points with high positive responses, including the statement point, "The work instructions on the activity sheet are easy to understand." It can be seen that the instructions on this activity sheet are very easy to direct students in working on the activity sheet while also understanding the biotechnology material. According to Marzano (2017), work instructions in teaching materials such as activity sheets are very important to help students understand what is expected of them, the steps that must be followed, and how to complete assignments correctly, thereby reducing errors in work and increasing time efficiency. The students' positive response regarding the clarity of the work instructions proves that students are able to understand what will be done when learning using PjBL-based activity sheets takes place.

Based on Table 6, there is a statement point that has the lowest value, namely "The activity steps in this activity sheet are easy to carry out" with an average percentage value of 84.7% in the very positive category. This can happen because the activity sheet contains a structured activity process and requires experience and time to carry it out, so there are some students who consider the task given to be difficult to carry out due to lack of experience or limited time management. According to Tomlinson (2017), some students who have these deficiencies tend to feel overwhelmed and discouraged, so they have difficulty completing the assignments given. What should be done to overcome this problem is to provide motivation so that students do not give up easily and prepare students to make a backup plan if there is a failure in making the product so that the decision-making process is faster and more efficient because there are options that have been considered beforehand. Besides that, the teacher can help direct students to create a timeline so that students can easily organize assignments.

## CLOSURE
### Conclusion
The application of learning with Project Based Learning based activity sheets in practicing bioentrepreneurship skills in biotechnology material, overall in all classes, can be carried out in a very good category reaching 95.8% in all aspects that have been observed.

The students' bioentrepreneurship skills in all classes were 94.5% in the very good category. The results of the data on indicators of students' bioentrepreneurship skills are shown from the results of the pre-test and post-test in class X8, which is 91.3% complete. In class X 9 91.6% are complete. Based on the results of the n-gain test in two classes, it can be seen that there is an increase in bioentrepreneurship skills, which is known through the pre-test and post-test at the beginning and end of learning using Project Based Learning based activity sheets.

The responses given by students included very positive responses (95.73%) to learning using Project Based Learning activity sheets.

### Suggestion
The process of making biotechnology products takes quite a long time, so the practicum must be carried out according to the correct method to avoid repetition or failure of the experiment.

During the learning and practicum process, teachers should be firm and disciplined in managing time so that activities in working on activity sheets can be completed accurately and quickly.

In practical activities, teachers should be more assertive in guiding students regarding cooperation and discussions with groups so that each student does not outperform each other.

### Acknowledgement

### REFERENCES

Afriana, J., Permanasari, A., & Fitriani, A. 2016. Penerapan *Project-Based Learning* Terintegrasi STEM untuk Meningkatkan Literasi Sains Siswa Ditinjau dari Gender. *Jurnal Inovasi Pendidikan IPA*, 2(2), 202. https://doi.org/10.21831/jipi.v2i2.8561

Afwan, B., Suryani, N., & Ardianto, D. T. 2020. Analisis Kebutuhan Pembelajaran Sejarah di Era Digital. *Proceding Literasi Dalam Pendidikan Di Era Digital Untuk Generasi Milenial*, 1(1), 9.

Amalia R. 2023. Validitas dan Kepraktisan LKPD PjBL (Project- Based Learning) Materi Bioteknologi untuk Melatihkan Keterampilan *Bioentrepreneurship*. *Jurnal BioEdu*, Vol. 12, No. 2, 515-524.

Arief S. Sadiman, 2006. *Media pendidikan: Pengertian, Pengembangan dan Pemanfaatannya*. Jakarta: PT Raja Grafindo Persada.

Damayanti, Jihan, Evie Ratnasari. 2021. Profil dan Validitas Lembar Kegiatan Peserta Didik - Elektronik (E-LKPD) Berbasis *Bioentrepreneurship* untuk Melatihkan Keterampilan Berwirausaha dalam Era Industri 4.0. *BioEdu* Vol.10/No.3

Fathurrohman, Muhammad. 2016. *Model-model Pembelajaran Inovatif*. Yogyayakarta: Ar-ruzz Media

Fitri, Elvi Era, Evie Ratnasari, Widowati Budijastuti. (2014). Pengembangan LKS *Bioentrepreneurship* Pembuatan Nata De Lerri Materi Bioteknologi Konvensional Kelas XII SMA. *BioEdu* Vol.3/No.3

Kurniawati, Agnes Mega. 2018. *Analisis Keterlaksanaan Model Pembelajaran Problem Based Learning dan Efektivitasnya terhadap Keterampilan Proses Sains pada Materi Sistem Koloid Kelas XI SMA Negeri 1 Batanghari*. Jurusan PMIPA, FKIP Universitas Jambi.

Machin, A. 2012. Pengembangan Model Pembelajaran Bioteknologi Bervisi Kewirausahaan di Sekolah Menengah Atas. *Jurnal Bioedukasi*, 5(2), 50-60.

Marzano, R. J. 2017. *The New Art and Science of Teaching: More Than Fifty New Instructional Strategies for Academic Success*. Bloomington, IN: Solution Tree Press

Prihatiningrum, P., Susilowati, S. M. E., & Prasetyo, A. P. B. 2019. Effect of Bioentrepreneurship on Biology Learning Achievement, Creativity, and Entrepreneurial Interest. *Journal of Innovative Science Education*, 9(3), 250-259.

Purnomo, E., dkk. 2015. Efektivitas Penerapan Model Pembelajaran *Project Based Learning* (PBL) Berbasis Mata Kuliah Kalkulus Lanjut II. *JKPM* (online) vol 2(2): 20-24, FMIPA dan FT UM, Semarang, FKIP UT. https://jurnal.unimus.ac.id/index.php/JPMat/article/view/1700

Rompegading Andi. 2023. *Dasar-dasar Bioteknologi (Teori dan Praktik)*. Sumatra Barat: Insan Cendekia Mandiri

Sugihartono, Fathiyah, K. N., Setiawati, F. A., 2007. *Psikologi Pendidikan*. Yogyakarta: UNY Press.

Tomlinson, C. A. 2017. *How to Differentiate Instruction in Academically Diverse Classrooms*. ASCD.