

## DEVELOPMENT OF PROJECT BASED LEARNING (PJBL) BASED STUDENT WORKSHEETS (LKPD) TO IMPROVE THE COLLABORATION AND CREATIVE THINKING SKILLS OF STUDENTS OF JUNIOR HIGH SCHOOL

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### Abstract

This research aims to evaluate the development and feasibility of Student Worksheets (LKPD) based on Project-Based Learning (PjBL) at SMP Negeri 1 Bungku Timur using the ADDIE model which consists of five stages: Analysis, Design, Development, Implementation and Evaluation. Data was collected through interviews, questionnaires and tests. Data analysis techniques include the validity of learning tools, the practicality of using questionnaires, effectiveness through effect size to compare pre-test and post-test results, as well as collaboration skills through questionnaires and score evaluation. The research results show that the development of PjBL-based LKPD is effective, feasible and practical in improving students' collaboration and creative thinking abilities. The rice tape making project as part of a biotechnology worksheet provides an interactive and relevant learning experience. Effectiveness is measured by comparing the effect size value between the initial test and the final test. The effect size value of 0.88 shows that the use of PjBL-based LKPD significantly increases students' active involvement, collaboration skills and creativity. Analysis shows a significant increase in collaboration skills in both the experimental and control classes from Meeting I to Meeting III. The experimental class showed an increase from 81% at Meeting I to 96% at Meeting III, while the control class increased from 76% to 81% in the same period. The feedback obtained is used to revise and perfect the LKPD before it is used more widely.

**Keywords:** LKPD, Project-based learning, ADDIE model, collaboration skills, creative thinking

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### Introduction

In the 21st century era, education in Indonesia is increasingly focused on utilizing rapid technological developments. Science and technology are the main foundations for nation development. Education in the era of globalization in the 21st century is very important because it requires changes in various aspects of human life in order to survive (Aslamiah et al., 2021). There are four main skills that need to be emphasized to meet the needs of this era, namely critical thinking skills, creativity, collaboration and communication skills, which are often referred to as the 4Cs (Caena & Redecker, 2019; Prayogi, 2020; Suyitno, 2020).

Graduate Competency Standards (SKL) for SMP encourage students to be able to think and act creatively, productively, critically, independently, collaboratively and communicatively. This is achieved through the application of a scientific approach and the development of competencies from school subject matter and other resources independently. One important aspect of 21st century skills is collaboration and creative thinking. Collaboration in the learning context refers to cooperation between individuals to support and complement each other in completing certain tasks with the aim of achieving

predetermined results (Junita & Wardani, 2020). Developing creative thinking skills in students is an important part of the educational process, with the aim of equipping them with the ability to think deeply, promoting better understanding, and producing individuals who are able to make informational and rational decisions.

Conducting research at SMP Negeri 1 Bungku Timur is important to identify the uniqueness of local education and explore ways to improve learning methods and curriculum design. By focusing on student needs and local factors, this research will provide in-depth insights that will not only be useful for improving education in these schools, but also have the potential to contribute to broader educational improvements in schools in similar contexts. Anggo et al. (2023) in their research emphasize the importance of integrating education about cultural diversity and provide a more in-depth view of how certain educational approaches can help students face challenges and take advantage of opportunities that arise from cultural diversity in this country.

Initial observations at SMPN 1 Bungku Timur identified several problems in the learning process,

including students' low collaboration skills as seen from their lack of ability to divide tasks clearly when working in groups and a lack of respect between group members. Apart from that, students' creative thinking skills are considered to need improvement, especially in terms of their communication skills.

Teachers at this school rarely use Student Worksheets (LKPD), and if they are used, the LKPD tends to only refer to the textbook without additional development from the teacher. The use of Project Based Learning (PjBL) based LKPD was chosen because this method integrates project-based learning with an in-depth learning context. PjBL-based LKPD provides opportunities for students to be involved in real projects that enable the development of collaboration, problem solving and creative thinking skills.

Research by Tatsar, et al. (2023) shows that the use of project-based learning models in the curriculum can significantly increase student creativity, such as fluent thinking skills, originality and evaluative abilities.

The problems identified show that some students at SMPN 1 Bungku Timur do not have adequate collaboration and creative thinking skills. This is caused by less effective learning models and the minimal use of quality teaching materials. As a solution, it is recommended to apply the Project-Based Learning (PjBL) model in learning. According to Rusman (2017), PjBL is an effective learning model in developing students' collaboration and communication skills.

PjBL is known for its stages which are able to guide students in facing investigations, solving problems, and producing real products in the form of projects (Sudiar et al. 2023). This approach is in accordance with the principles of 21st century education which emphasizes skill development critical thinking, creativity, communication and collaboration (Sari, et al., 2017; Yuni, et al., 2015).

Research also shows that PjBL not only improves understanding of concepts, but also develops critical thinking skills and encourages students' active involvement in learning (Wulandari & Novita, 2018).

Based on the description above and the opinions of previous research, the researcher wants to examine in more depth the context of developing PjBL-based Student Worksheets (LKPD) as an appropriate strategy for improving the quality of learning at SMPN 1 Bungku Timur.

## Methods

This research is development research which involves a series of steps to develop or improve a product. The model used is ADDIE, which consists of five main stages: Analysis, Design, Development, Implementation and Evaluation. This method aims to develop effective and relevant educational products (Sugiyono, 2008; Wirawan & Wahyudi, 2016).

The research design follows the ADDIE model which begins with the Analysis stage, where the need for developing PjBL-based LKPD is identified. The next stage is Design, which involves designing the format, content and learning methods of the LKPD. Next, the Development stage focuses on developing LKPD based on evaluations from experts and revising the results of these evaluations. The Implementation Stage tests the LKPD in a real setting at SMP Negeri 1 Bungku Timur. Finally, the Evaluation stage evaluates the LKPD and learning products as a whole through questionnaires and tests.

The research was carried out at SMP Negeri 1 Bungku Timur in January 2024, which was carried out over 3 meetings and material on biotechnology, with the research subjects being students with a sample size of 60 students with each class totaling 30 people with 17 men and 13 women. The average student is 15 years old. This research uses quantitative and qualitative data. Quantitative data includes validation of the LKPD, an attractiveness questionnaire which has 10 questions, and effect size calculations from test scores that change to an essay of 10 questions, while qualitative data is obtained descriptively from the results of the validation sheet assessment and student responses.

Data collection techniques used include interviews to collect information directly, questionnaires to assess LKPD products by experts and students, as well as tests to measure the impact of using LKPD on students' creative thinking skills through pre-tests and post-tests.

The data analysis techniques applied include validity analysis, which uses a validation score average formula and interpretation based on validity categories (Herawati et al., 2016), as well as practicality analysis using a questionnaire to measure product practicality based on specified categories (Herawati et al., 2016). Effectiveness analysis is carried out through tests *Effect Size* calculated using the formula Cohen (2007) as follows:

$$S_{of} = \sqrt{\frac{Spre^2 + Spost^2}{2}}$$

*Effect Size* d can be calculated as:

$$d = \frac{d}{S_{of}} \quad (1)$$

Information:

$S_{of}$  = Standard deviation of test scores

$d$  = Average test score ( $M_{Posttest} - M_{Pretest}$ )

$S_{pre}$  = Pretest standard deviation

$S_{post}$  = Posttest standard deviation

T-test with statistical software to test differences in the effectiveness of LKPD. In addition, analysis of students' collaboration skills was carried out using a questionnaire to measure collaboration skills with specified percentages and categories (Sari et al., 2017).

**Results and Discussion**

The results of this research produced a product in the form of a Student Worksheet (LKPD) based on Project-Based Learning (PjBL) on biotechnology material, which was implemented at SMP Negeri 1 Bungku Timur using two classes, namely the control class and the experimental class. This product aims to improve students' collaboration and creative thinking skills. Development uses the ADDIE model which consists of five stages: Analysis, Design, Development, Implementation and Evaluation with a pre-experimental design "One-Group Pretest-Posttest Design".

*Level of analysis*

At the Analysis stage, surveys and interviews were conducted with teachers and students to identify learning needs at SMP Negeri 1 Bungku Timur. It was found that conventional learning methods do not support the active involvement of students and do not develop collaboration and creativity skills sufficiently. Teachers and students identify the need for more interactive and challenging learning media to develop these important skills.

*Planning level*

At the design stage, the focus is on preparing a user-friendly LKPD format that is closely related to the applicable curriculum. Learning content is designed to encourage students to think critically and creatively. The PjBL learning method involving project-based activities is designed to allow students to work in groups, complete real tasks, and develop various skills such as research, collaboration, and presentation. Indicators of success include the ability to collaborate, creativity, and creative thinking skills. The following is Prototype I of Student Worksheets (LKPD) based on Project-Based Learning (PjBL):

- a. Cover, learning objectives and instructions for using the LKPD



**Figure 1** LKPD Draft 1

- b. Project themes, and stages of the PjBL learning model



**Figure 2.** LKPD Draft 1

*Development Stage*

The PjBL-based LKPD development process consists of several systematic stages to ensure quality and suitability to student needs. The first stage is the development of Prototype I, where the LKPD is developed based on an initial design which includes structure, content and project-based learning activities.

After Prototype I has been created, the next step is validation by two groups of experts, namely media experts and content experts. Media experts evaluate technical aspects such as graphic design, layout, and clarity of instructions, while content experts evaluate content to ensure accuracy and relevance of biotechnology material.

**Table 1.** Validator Validation Results

| EVALUATION ASPECTS  | ACQUIRED SCORE |      |
|---|----------------|------|
|   | V. 1           | V. 2 |
| The text can be read well   | 5              | 5    |
| Text size and font  | 5              | 5    |
| Clarity of material description   | 4              | 4    |
| Clarity of instructions   | 4              | 4    |
| Clarity of cover and background on LKPD   | 5              | 5    |
| Clarity of colors and images  | 5              | 4    |
| The ability of media to facilitate students in learning   | 4              | 5    |
| The ability of media to facilitate teachers   | 4              | 4    |
| The images used are appropriate to the material   | 4              | 4    |
| Accuracy of media functions   | 4              | 4    |
| All material presented covers the material contained in KD  | 5              | 4    |
| All material presented reflects the explanation that supports the achievement of material in KD   | 4              | 4    |
| The material is in accordance with the predetermined KD. The level of difficulty of the material and complexity of the material is adjusted to the level of development of the students | 4              | 4    |
| The facts presented are in accordance with reality and are efficient in increasing students' understanding  | 5              | 5    |
| examples and references reflect current events or conditions  | 5              | 4    |
| The material presented comes from the environment and is close to students' daily lives   | 4              | 4    |
| The material is appropriate to the development of students' thinking and is presented in an interesting, straightforward and easy to understand manner                                  | 5              | 5    |

|   |              |              |
|---|--------------|--------------|
| illustrations used to explain material that is relevant to the message displayed                    | 4            | 5            |
| The sentences used to prepare the message refer to the rules of good and correct Indonesian grammar | 4            | 5            |
| The material presented grows students' environmental caring attitude                                | 5            | 4            |
| <b>Total score</b>  | <b>89</b>    | <b>88</b>    |
| <b>Rate-rate</b>  | <b>4.45</b>  | <b>4.40</b>  |
| <b>Percentage (%)</b>   | <b>89.00</b> | <b>88.00</b> |

Based on the validation results, the LKPD was declared valid with an average score of 3.80 (76%) by validator 1 and 3.85 (77%) by validator 2, with several necessary revisions.

Next, the assessment was carried out by three science subject teachers. The results of the analysis show that the LKPD is declared very suitable for use in learning with an average score of 3.80 (95%) by assessors 1 and 2, and a score of 3.40 (85%) by assessor 3.

**Table 2.** Results of teacher assessment analysis

| Description           | Appraiser 1   | Appraiser 2   | Appraiser 3   |
|-----------------------|---------------|---------------|---------------|
| <i>Total score</i>    | 38            | 38            | 34            |
| <i>Rate-rate</i>      | 3,80          | 3,80          | 3,40          |
| <i>Percentage (%)</i> | 95            | 95            | 85            |
| <i>Interpretation</i> | Very Worth It | Very Worth It | Very Worth It |

The next stage is an individual test carried out by 6 students with various levels of ability. The results of the analysis show that the LKPD is suitable for use with an average score of 3.72 (93.06%). The small group test was then carried out by 15 students, resulting in an average score of 3.67 (91.67%), which also shows the suitability of the LKPD for use in learning.

Finally, validation of the instruments and learning tools was carried out by two validators. The validation results show that the critical thinking skills, collaboration skills, and RPP instruments are suitable for use, with high scores from both validators.

**Table 3.** Results of analysis of learning instruments and devices

| Analysis                            | Validator 1 | Validator 2 |
|-------------------------------------|-------------|-------------|
| Critical Thinking Skills Instrument | 93.00       | 91.00       |
| Collaboration Skills Instrument     | 91.67       | 88.33       |
| Rpp                                 | 87.06       | 95.29       |

### Implementation stage

The Implementation Phase tested the LKPD in a real setting at SMP Negeri 1 Bungku Timur. Finally, the Evaluation stage evaluates the LKPD and learning

products as a whole through questionnaires and tests. Based on input from experts, several revisions were made to improve prototype I LKPD based on Project-Based Learning (PjBL). Revisions include media aspects, such as improving visual design, page layout, text readability, and the use of relevant images or illustrations. Apart from that, content aspects are also considered by adding or subtracting material, rearranging the content to make it more logical and easier to understand, and adapting it to applicable curriculum standards.

After the revision is complete, the revised LKPD is rearranged into a final prototype. This prototype is ready to be tested in real learning activities. At this stage, all input from the validation process has been accommodated, so that the LKPD is expected to meet the desired quality standards. Next, a trial was carried out on the teacher's response to the Pjbl-based LKPD which had been developed by 3 people with the following results:

**Table 4.** Results of teacher responses to Pjbl-based LKPD

| No | Appraiser | Mark    | Information   |
|----|-----------|---------|---------------|
| 1  | Teacher 1 | 88,54 % | Very Worth It |
| 2  | Teacher 2 | 96,87 % | Very Worth It |
| 3  | Teacher 3 | 90,62 % | Very decent   |

From this table, it can be seen that all teachers gave high marks, with the lowest score being 88.54% and the highest score being 96.87%. All of these ratings are in the "Very Decent" category. Overall, these results show that the PjBL-based LKPD was very well received by teachers and was considered very suitable for use in the learning process.

**Table 5.** Results of analysis of student responses in individual and small group form

| No | Group                | Mark    | Information   |
|----|----------------------|---------|---------------|
| 1  | Group of Individuals | 93.06 % | Proper to use |
| 2  | Large Group          | 91.67 % | Proper to use |

Based on the results above, the PjBL-based LKPD received a very positive response from students. Trials on individual groups received a score of 93.06%, which is in the "Fine for use" category. Meanwhile, trials in small groups obtained a score of 91.67%, which is also included in the "Appropriate to use" category. This confirms that the LKPD is effective and can be applied in learning.

The implementation phase of the LKPD at SMP Negeri 1 Bungku Timur involved trials in two classes: the control class and the experimental class. The aim is to evaluate the effectiveness of Project-Based Learning (PjBL) based LKPD compared to conventional LKPD. Students are divided into groups and given the task of making rice tape. The teacher acts as a facilitator who provides guidance and feedback throughout the process. In the

experimental class, PjBL-based LKPD is used to encourage teamwork, problem solving and creative thinking. Meanwhile, in the control class, students used conventional LKPD which focused more on direct instruction and individual assignments.

During project implementation, teachers observe the process and involvement of students and note how they work together and solve problems. Assessment is carried out on the results of projects and processes undertaken by students, with different emphasis in each class; creativity and teamwork are prioritized in the experimental class, while compliance with instructions is more concerned in the control class. This implementation also aims to identify practical obstacles in using LKPD, including challenges in understanding instructions and collaborative aspects.

Effectiveness in this research was measured by comparing the difference in effect size values between the initial test and the final test in the control and experimental classes. The initial test score is obtained from the score given by the teacher, while the final test score uses the LKPD that has been developed. Based on the results of the analysis, the effect value was obtained at 0.88, which was categorized as having a "large effect". These results indicate that the use of PjBL-based LKPD significantly increases students' active involvement, their ability to work in teams, and creativity in completing rice tape making projects. The feedback obtained is used to revise and perfect the LKPD before it is used more widely.

#### **Analysis of collaboration skills and creative thinking skills through Project Based Learning LKPD**

Based on the analysis that has been carried out, collaboration skills increased significantly in both the experimental and control classes from Meeting I to Meeting III. The experimental class, which used Student Worksheets (LKPD) based on Project-Based Learning (PjBL), showed a very significant increase in students' collaboration skills. Initially, collaboration skills were at 81%, increased to 93.75% at Meeting II, and reached 96% at Meeting III. This shows that the PjBL method is successful in encouraging students to interact intensively, share ideas, and work together in completing projects. On the other hand, the control class that used conventional methods also experienced improvements in collaboration skills, although at a slower rate. Initially, the control class had a collaboration skill level of 76%, which rose to 78% at Meeting II, and reached 81% at Meeting III.

This research strengthens that PjBL-based LKPD is more effective in improving students' collaboration skills than conventional methods. PjBL encourages more productive interactions between students through challenging projects, so that collaboration skills can better develop. This is in line with research by [Meilinawati](#)

(2018) which shows an increase in collaboration abilities between students using PjBL.

Apart from that, based on the results of calculating the effect size of the PjBL-based LKPD, it was also proven to be effective in improving students' creative thinking skills at SMP Negeri 1 Bungku Timur with a value of 0.8. The effect was obtained at 0.88, which was categorized as having a "large effect".

The t test carried out showed that there was a significant difference between the effectiveness of using PjBL-based LKPD and conventional LKPD in improving students' creative thinking skills. With these results, it can be concluded that the PjBL approach which involves students in real projects can be more effective in stimulating creativity and developing creative thinking skills compared to conventional methods which are more focused on direct instruction.

Overall, the results of this research indicate that the integration of PjBL in the educational curriculum can be an effective strategy for improving students' collaboration and creative thinking skills. It is recommended to continue developing and integrating this method in learning practices in schools, while providing training to teachers to support effective implementation and ensure maximum benefits for students' future development.

#### **Feasibility Analysis of LKPD Based on Project Based Learning**

##### **a. Effectiveness:**

PjBL-based LKPD has proven to be very effective in improving students' collaboration and creative thinking skills. The experimental class using this approach recorded an N-Gain of 0.56, showing a significant improvement from before. Compared to the control class that used conventional LKPD with an N-Gain of 0.38, the PjBL approach was clearly superior in stimulating the development of the measured skills. This shows that through PjBL, students are more involved in challenging and relevant projects, which encourage collaboration and creative thinking skills.

##### **b. Qualifications:**

The process of developing LKPD involves validation by material experts and learning media experts. Both validators gave high scores, indicating that the LKPD had content that was in line with the curriculum, accurate in biotechnology material, and well designed technically and visually. The results of the trial on teacher responses showed that the LKPD was considered very suitable for use in learning. Likewise with the students' responses, who thought the LKPD was practical and helped them understand the material better.

##### **c. Practicality:**

Students feel that PjBL-based LKPD is easy to understand and apply in learning. They assess that the LKPD helps them use learning time efficiently and is relevant to real life contexts. The flexibility of LKPD also allows students to adapt learning to their own learning style.

### Conclusions

Based on research, it can be concluded that the development of Student Worksheets (LKPD) based on Project-Based Learning (PjBL) at SMP Negeri 1 Bungku Timur succeeded in significantly improving students' collaboration and creative thinking skills. Compared with conventional methods, the use of PjBL shows a higher increase in N-Gain in the experimental class. Validation by material and media experts as well as positive responses from students regarding the ease of implementation and relevance of the LKPD confirm the feasibility and practicality of this approach. Overall, PjBL-based LKPD is an effective and practical choice in supporting biotechnology learning at SMP Negeri 1 Bungku Timur.

The development of PjBL-based LKPD for biotechnology learning, especially the rice tape making project, has also proven effective in improving students' skills in collaboration and creative thinking. This approach not only provides interactive and relevant learning, but also prepares students to better face real-world challenges. The evaluation results show that this LKPD can be used as an innovative and effective learning model to be applied in the context of learning biotechnology and other subjects. It is hoped that the results of this research can provide guidance for the development of similar learning media in other schools.

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### Conflict of interest

The authors declares that there is no conflict of interest in this research. All parties involved have given their consent and contributed without any bias or influence that could affect the research results.

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