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Development of Project-Based Student Work Sheets (LKPD) Based on Biotechnology Materials

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Abstract. *This study aims to produce Student Worksheets (LKPD) BasedProject Based Learning(PjBL) Biotechnology materials that are valid and practical. This type of research is research and development (R&D). The development of this LKPD refers to the ADDIE model. The ADDIE stages consist ofAnalysis, Design, Development, Implementation, and Evaluation. The research instrument was validated by two expert validators. LKPD was validated in two stages. Results The percentage of stage I is 78.5% in the valid category. The results of the second stage percentage, namely 88.2%, are in the very valid category. The results of the teacher response questionnaire analysis were 85.28% in the very practical category and the student response questionnaire results obtained a value of 81.15% in the very practical category. Based on these results it can be concluded that the development of Student Worksheets (LKPD) is BasedProject Based Learning (PjBL) Biotechnology material isvalid and practical to use in the learning process.*
Keywords: *Biotechnology,Validity, Practical, LKPD, PjBL*

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Introduction

Education basically involves interaction between educators and students in which there is a learning process. (Hamid, Nurhayati, & Ali, 2015). Learning success is not only determined by educators, but is determined by the activeness of learners. Educators only act as facilitators, evaluators and motivators not as the only source of learning. Learning is said to be successful if most students are actively involved both physically, mentally, and socially. (Halifah & Adnan, 2018). Thisis in accordance with Law No. 19 of 2005 which states that ideal learning is learning that is interactive, fun and can motivate students to participate actively.The current quality of education is far from expected. Various efforts have been made by the government to improve the quality of education, one of which is through curriculum improvements (Rukmalasari, Yusminah and Oslan, 2020). In the independent curriculum, learning that was originally teacher-centered changed to student-centered (Setiawan et al, 2022). Learner-centered learning requires active participation from learners and discussion with the teacher as a facilitator. Students are expected to develop their creativity by exploring learning resources independently so that a critical thinking process occurs (Pertiwi, Siti, & Syofiyah, 2022). The reality in the field, the learning system has not been fully effective in achieving active and efficient learning goals. Based on observations at SMAN 9 Makassar, it was found that in the learning process, teachers are more dominant in using the teacher-centered lecture method (*teacher center learning*) this makes participants passive because they only focus on listening and recording teacher explanations. In addition, teacher learning media more often use textbooks because of the limited availability of teaching materials. Based on the results of an interview from one of the class X biologyteachers, he stated that the teaching materials used were in the form of textbooks that had been provided by the school but the materials were still combined with

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other subjects such as physics and chemistry (Integrated Science).

Teachers also do not have Student Worksheets (LKPD) that are tailored to the needs of students. The LKPD used has not been able to actively involve students. This is because students only follow the procedures that are available in the LKPD. Students are only limited to moving material from the textbook to the answer sheet. This does not provide opportunities for students to participate actively, does not train the ability to think and collaborate to acquire knowledge independently.

Based on these problems, teaching materials are developed that can increase student involvement during the learning process and practicum activities. One of the teaching materials that can be used is the Student Worksheet (LKPD) which contains a guide for practicum activities based on *Project Based Learning* (PjBL). This learning model was chosen because it can encourage studentsto be active in the learning process.

Research Methods

The type of research carried out is research and development or *Research and Development*. The study was conducted at SMA 9 Makassar in June involving 2 biology learning expert validators as well as 20 respondents of grade X students and 2 respondents of biology subject teachers. The research instruments used were biology learning expert validation sheets, teacher response questionnaires, and student response questionnaires with Likert scale types. This research produced a product in the form of Student Worksheets (LKPD) Based *on Project Based Learning* (PjBL) Biotechnology Materials. The development model used refers to the ADDIE model. This model is a development model developed by Branch (Lusyana &; Tri, 2022) consisting of: *Analysis*, Design, *Development,* Implementation, and Evaluation*.*

Data collection techniques are carried out through observation and questionnaires. The data collection process is carried out by distributing questionnaires related to the needs of students and observation of the learning process. Data analysis used in this study by calculating expert validation data and teacher and student response data.

1. Validity Analysis

The validity of research products is assessed by biological learning expert validators. For quantitative analysis, the answers can be scored using the Likert scale reference as follows.

Table 1. Expert Validation Assessment

Expert Validation Assessment	
Description	**Score**
Very Good	5
Good	4
Good Enough	3
Not Good	2
Very Not Good	1

Source: Ami, (2021)

The assessment validation results in the validation sheet are analyzed using the following formula.

$$\text{Level of validity} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

Furthermore, after getting the percentage value, it is then entered into the validity test criteria basedon the following table.

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Table 2. Expert Validation Assessment Categories

Penilaian	Tingkat Kevalidan
81% ≤ V ≤ 100%	Very valid or can be used without revision
61%≤ V < 80%	Valid or usable but needs minor revision
41%≤ V < 60%	Less valid, it is recommended not to use it because it needs major revisions
21%≤ V < 40%	Invalid or may not be used
0%≤ V < 20%	Very invalid or shoud not be used

Source: Qodriyah (2021)

2. Practicality Analysis

Practicality analysis based on teacher and student responses was used to collect data on teacherand student responses to LKPD based on Project Based Learning biotechnology material developed.The data is then applied in the form of numbers, which are as follows.

Table 3. Practicality Assessment Scores

Practicality Assessment Score	
Description	**Score**
Very Agree	5
Agree	4
Less Agree	3
Disagree	2
Very Disagree	1

Source: Ami, (2021)

Furthermore, the data obtained is analyzed by calculating the percentage of answers based onthe scoring of each answer from respondents with the following formula.

$$P = \frac{\text{Average Teacher Assessment}}{\text{Maximum Score}} \text{ x } 100\%$$

Table 4. Practicality Categories

Assessment	Level of practicality
81% ≤ P < 100%	Very Practical or can be used without revision
61% ≤ P < 80%	Practical or usable but needs minor revisions
41% ≤ P < 60%	Less practical, it is planned not to be used because it needs major revisions
21% ≤ P < 40%	Impractical or should not be used
0% ≤ P < 20%	Very Impractical or should not be used

Source: Qodriyah (2021)

Results and Discussion

The results of this study are in the form of Project Based Learning (PjBL)-based Student Worksheets (LKPD) of feasible biotechnology materials based on validity tests and practicality tests.

a. Validity Results

Validity tests are carried out to determine the weaknesses and shortcomings of products

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that havebeen developed. The components assessed are aspects of LKPD display, completeness of LKPD components, feasibility of content, presentation, and language. The data on product validation resultscan be seen in Table 5 below.

Table 5. Results of PjBL-Based LKPD Validity Analysis Phase I

No.	Assessment Aspect	Average Rating	Criteria
1.	LKPD Display	80%	Valid
2.	Completeness of LKPD Components	84%	Highly Valid
3.	Material Eligibility	80%	Valid
4.	Serving	77%	Valid
5.	Language	72,5%	Valid
	Average percentage	**78,7%**	
	Percentage rate	**61%≤ V < 80%**	
	Criteria	**Valid**	

Based on Table 5, an average percentage of 78.7% is in the valid category to be tested to schools.However, there are some suggestions on some parts that need to be improved so that the product becomes better. Therefore, the product is repaired again according to suggestions and input from validators. After that, the product is revalidated by expert validators of biology learning. The results of validation II can be seen in Table 6 below.

Table 6. Results of Phase II Validation by Biology Learning Experts

No.	Assessment aspect	Average Rating	Criteria
1.	LKPD Display	87,5%	Highly Valid
2.	Completeness of LKPD Components	96%	Highly Valid
3.	Material Eligibility	85%	Highly Valid
4.	Serving	85%	Highly Valid
5.	Language	87,5%	Highly Valid
Average percentage		**88,2%**	
Percentage rate		**81% ≤ V ≤ 100%**	
	Criteria	**Highly V**	**alid**

Based on Table 6, it was obtained that the average percentage value of the entire aspect of 88.2% was in the very valid category so that the developed PjBL-based LKPD was suitable for use without revision and could be tested in schools. From the average validator assessment results, it canbe concluded that the PjBL-based LKPD that has been developed is feasible to use with a little revision.

b. Practical Results

1. Teacher Response Questionnaire

This practicality questionnaire aims to obtain information about the practicality of LKPD based on teacher assessment and consideration. The results of the teacher response questionnaire assessment can be seen in Table 7 below.

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Table 7. Teacher Response Questionnaire Assessment Results

No.	Assessment aspect	Average Rating	Criteria
1.	Content Eligibility	82,85%	Very Practical
2.	Serving	83%	Very Practical
3.	Language	90%	Very Practical
Average percentage		**85, 28%**	
Percentage rate		**81% ≤ P < 100%**	
	Criteria	**Very Practical**	

Based on Table 7, an average percentage value of 85.28% was obtained with a very practical category. Thus, the PjBL-based LKPD that has been developed has met the practicality requirements based on teacher assessment.

2. Student Response Questionnaire

Student response questionnaires aim to obtain information about the practicality of learning tools based on responses from students. The results of the student response questionnaire assessment can be seen in Table 8 below.

Table 8. Student Response Questionnaire Results

No.	Assessment Aspect	Average Rating	Criteria
1.	LKPD Display	84,25%	Very Practical
2.	Content Eligibility	80,5%	Practical
3.	Language	84%	Very Practical
4.	Serving	75,85%	Practical
Average percentage		**81,15%**	
Percentage rate		**81% ≤ P < 100%**	
	Criteria	**Very Practical**	

Based on Table 8, an average percentage value of 81.15% was obtained with a very practical category. Thus, the PjBL-based LKPD that has been developed has met the practicality requirements based on the analysis of student responses.

Discussion

This research produces PjBL-based LKPD products for valid and practical biotechnology materials based on assessments from biological learning expert validators, biology teachers and students. This is in line with Hanafi (2017), which states that development research aims to produce certain products and test the validity and effectiveness of these products. This research begins with the analysis stage. The analysis stage aims to see a picture of conditions in the field related to the learning process and then analyze the problem. (Sastria, Novinovrita, and Toni, 2020). Based on the results of curriculum analysis, student analysis, task analysis and needs analysis, the problems faced can be identified, namely: teaching materials used in the learning process in the form of package booksand LKPD. However, the LKPD has not activated students. In addition, the delivery of material moreoften uses the lecture method so that it makes students passive and does not provide opportunities forstudents to reconstruct their own knowledge.

The design stage is carried out with several designs, namely: the preparation of expert validation instruments, the preparation of teacher and student response questionnaire instruments andthe design of PjBL-based LKPD. This stage aims to design the initial design of the

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product consisting of covers, learning outcomes, learning objectives, instructions for using LKPD, activities that will becarried out by students that are adjusted to the PjBL-based learning syntax, discussion questions, making reports and assessing students. This is in accordance with Trianto's statement in Triana (2021),the components of LKPD include titles, brief theories about materials, tools and materials, procedures, observational data, as well as questions and conclusions for discussion.

The LKPD that has been designed is then developed. At the development stage, it is necessary to conduct a validity test to determine the feasibility of LKPD using assessment instruments to measure validity (Askar, Firdaus, and Syamsiah, 2019). Validity is the conformity of LKPD with activity sheets according to predetermined standards. Validity is determined from the results of expertassessment of the products developed (Hariningwang &; Herlina, 2020). LKPD validation covers fiveaspects, namely; LKPD display, completeness of LKPD components, content feasibility, presentation, and language. The average value of validation results in stage I is 78.7% which is in the valid criteria.Based on this, it can be concluded that the developed LKPD is feasible and can be tested, but becausethere are still some suggestions from validators, the LKPD is revised again.

The revised LKPD was then validated again in phase II. At this stage, the completeness component aspect of LKPD obtained the highest validation value of 96% with very valid criteria. This is because the developed LKPD already includes all the components needed in developing LKPD, namely containing titles, learning objectives, identity columns, instructions for use, learning outcomes, materials, PjBL activities, assessments and sufficient space to write answers. This is in accordance with Andi in Pawestri and Heri (2020), LKPD contains at least eight elements, namely; basic competency titles, completion time, equipment and materials needed to complete tasks, brief information, work steps, tasks to be done and reports to be done. The feasibility aspect of the materialand presentation obtained the lowest percentage value of 85%. This means that there are still several indicators that need to be improved so that the product becomes better. The average value of the results of phase II validation is 88.2%, this means that the LKPD developed is valid and feasible to be tested in the field based on the assessment of validators in accordance with Anikan's opinion in Safitri (2023),a product is said to be valid or practical if its validity meets the requirements of "sufficient" and the medium meets the criteria of very good or feasible.

The next stage is implementation. At this stage, product trials are carried out to determine thepracticality of the developed LKPD. The purpose of the practicality test is to see how well students understand the material and how well it is applied (Safitri, 2023). Practicality is a measure to determine the implementation of LKPD and show the responses or responses of teachers and students(Rejeki, Adnan, &; Asmawati, 2022). The average percentage of teacher responses is 85.28% with very practical criteria. The practicality test of student responses obtained a percentage of 81.15%. It can be concluded that LKPD is developed practically based on assessments from teachers and students. This is in accordance with Yamasari in Rejeki Adnan, & Asmawati, (2022), learning mediais said to be practical if it meets theoretical practical indicators, namely validators stating that teachingmaterials can be used by requiring little or no revision and practical practically based on the responses of teachers and students.

A practical LKPD is needed to make it easier for students to use LKPD (Rejeki, Adnan, &; Asmawati, 2022). The practicality value is obtained by looking at the aspects of practicality fulfilledby the developed device. This is in line with Sukandi in Revita (2019), these aspects are;

1) Usage, including easy to set, store and can be used at any time.
2) The time required in implementation should be short, fast and precise.
3) The appeal of the device to the interests of learners.
4) Easy to interpret by teachers, experts and students.

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5) It has the same equivalence so that it can be used as a substitute or variation.

The practicality of learning tools can be seen from several aspects, namely; Ease of use of learning devices for teachers and students, the time required, readability of the device and the presentation of the learning devices developed in the learning process in the classroom.

The evaluation stage is carried out to provide feedback to users, then revisions are carried outaccording to the evaluation results. In this study, the evaluation was carried out at the development stage based on suggestions and input from Biology learning expert validators and at the implementation stage based on suggestions and input from biology teachers as respondents in practicaltests.

Conclusion

1. The PjBL-based LKPD biotechnology material that has been developed is very valid and worth testing. Based on the results of validation by two biology learning experts with an average percentage of 88.2%.
2. PjBL-based LKPD, the biotechnology material developed is very practical to use in learning.Based on the results of teacher assessment, an average percentage of 88.2% was obtained andthe results of student assessment were 81.15%.

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