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DEVELOPMENT OF PROJECT-BASED LEARNING WORKSHEETS IN ELEMENTARY SCHOOL SCIENCE SUBJECTS

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Abstract

This research aimed to produce valid and practical Project Based Learning. PBL is being developed because this teaching method is considered effective in enhancing students' critical thinking skills, creativity, and problem-solving abilities, while bridging the gap between theory and practice in learning. The research and development method was employed with the subjects being fifth-grade students at Public Elementary School 140 Palembang for the 2023/2024 academic year. Student worksheets were developed using the ADDIE (Analysis et al., Evaluation) development model. Data collection techniques included observation, questionnaires (validation sheets, student and educator response sheets), and documentation. The results indicated that the student worksheets were classified as very valid, with an average validity score of 90.29% based on the validation questionnaire from media, material, and language experts. Practicality criteria were also very good, with an average score of 93.35% after being tested with students. Based on the results of the validation and practicality, the development of PBL-based student worksheets for Science subjects in fifth-grade elementary school is deemed ready for use in the learning process. This study makes a significant contribution to the implementation of PBL in elementary schools, offering valid and practical tools to enhance students' learning experiences and address the challenges of applying a more contextual and skills-oriented teaching method for the 21st century.

Keywords: Development Of Student Worksheets, Project Based Learning, Science

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INTRODUCTION

Project-based learning has become an increasingly popular teaching approach in recent years, particularly in the field of science education . This instructional method focuses on student-centered inquiry, where learners collaborate to investigate and answer driving questions through the creation of authentic artifacts . Project-based learning has been shown to enhance student engagement, deepen understanding, and develop essential skills such as critical thinking, problem-solving, and communication. In the context of elementary school science, the development of effective project-based learning resources, such as worksheets, is crucial to facilitate this approach and support student learning . Illustrated science worksheets that incorporate a scientific approach can help students actively construct their own knowledge, with the teacher acting as a mentor and motivator .

In science learning, especially in Class V Elementary School, there is one material that discusses Single and Mixed Substances, where in the learning process, there is a problem faced by students such as having a level of difficulty in understanding the subject matter caused by two factors, namely internal factors and external factors such as lack of activeness in learning and lack of use of modern teaching materials. Some research results state that the level of difficulty in understanding subject matter, especially science material, is caused by two factors, namely internal factors and external factors, namely based on research conducted by (Damayanti & Dikta, 2022; Levy & Moore Mensah, 2020) Based on the analysis of the interview questionnaire it is related to the difficulty of learning science of grade III B students at SDN 1 Bebalang because they need more understanding and help understanding the material. After all, the method used by the teacher still uses conventional methods. The problems experienced by students in class III B SDN 1 Bebalang are from the material of the form of objects, especially in gas material. The main factor causing this is that they need help understanding what gas is, and they cannot know the gas's form directly, making it difficult for them to understand the subject matter because they cannot make direct observations related to the material.

Based on initial observations through interviews with homeroom teachers, this was caused by two factors, namely internal and external factors. Internal factors can be caused by the students, such as a lack of interest in learning, health problems, and not having learning goals. In addition, external factors come from the environment, for example, in the school environment, the way teachers provide learning, the lack of availability of tools and learning, and the lack of support for using learning media to achieve learning. In the learning process, using conventional media causes students to be bored and less active. So, teaching aids such as materials are needed to support science learning. These teaching aids include parts that can be used in learning tools such as teaching modules or Learning Implementation Plans, Syllabus, and Learner Worksheets.

The objective of this research is to develop project-based Learning Worksheets (LKPD) for elementary school science subjects, specifically designed to enhance students' understanding of the concepts of "Single and Mixed Substances. The significance of comprehending these concepts lies in their foundational role in understanding various scientific principles and interactions between different substances. Difficulties in grasping these concepts often stem from ineffective teaching methods and the lack of engaging instructional materials. The development of project-based LKPD aims to provide more engaging and relevant instructional materials that facilitate active learning experiences and encourage students' deeper involvement in the learning process. By employing project-based LKPD, it is anticipated that students will improve their problem-solving skills, critical thinking, and practical abilities, while also increasing their motivation and academic performance in science education.

Teaching materials are the components teachers and students use to facilitate the learning process. This teaching material can be a reading book, a workbook, a proposal, and so on. Thus, teaching materials can be anything that is considered to add to students' training and experience (Kosasih, 2021; Rubtsov & Ulanovskaya, 2020). Teaching materials can be an intermediary between teachers and students, so teachers must recognize students' characteristics, intelligence, and abilities (Latifah et al., 2024; Short, 2021). Emphasises Learner Worksheets as printed teaching materials containing sheets containing materials, summaries, and instructions for learning projects related to the basic competencies (KD) to be achieved (Hariratuljannah et al., 2022). Meanwhile, (Anjarwati & Lubis, 2021) I suggest that the Learner Worksheet is teaching material that can assist teachers in learning, increase student activeness, and minimize teacher involvement. Learner Worksheets are sheets that usually contain questions that students will work on, and there are steps for solving them. (Sari & Lubis, 2021). Research indicates that worksheets based on contextual teaching significantly improve critical thinking skills among students learning about single and mixed substances. A study showed a validation score of 85.94% from material experts, confirming their effectiveness in enhancing learning outcomes (Saragih et al., 2022). This student worksheet is also concise teaching material, with independent exercise tasks so students can understand the existing material and facilitate learning.

Understanding material in project-based learning is crucial as it directly influences student engagement and comprehension. The interplay between physical and digital materials fosters a rich learning environment, enhancing students' ability to connect concepts and apply knowledge in practical contexts (Carvalho and Yeomman, 2021). While the focus on material understanding is vital, it is also essential to consider the potential challenges, such as the complexity of integrating diverse materials effectively in the curriculum. Balancing these aspects can lead to more effective educational practices.

Interesting student worksheets are those that vary, such as colored, given pictures, and questions in the form of colored images taken from the surrounding environment so that they attract students' attention to learning. (Haryani et al., 2022). Furthermore, the advantages of project-based Learning worksheets are that they can help students find new ideas and experiences, solve problems, and make products. Teachers can also encourage and support student creativity using experimental data and elaboration to make learning more meaningful. (Hayati et al., 2019).

Based on previous research that has links to the development of relevant Learner Worksheets and is used as research reference material, including Research conducted by (Dewi et al., 2020) With the title "Development of Project-Based Learning Worksheets for Grade V Elementary School Students." This study shows that the Learner Worksheet developed is very valid. Based on the media validation expert questionnaire sheet, material, and linguists, with an average validity value of 86.84%. For practicality, the average value is 92.2%, with very practical criteria. Moreover, for effectiveness, the average value is 83.33%. The research results of researchers entitled Development of Project-Based Learning Worksheets for Grade V Elementary School Materials show that the study has valid, practical, and effective criteria. The difference between previous research and this research is that previous research conducted by (Dewi et al., 2020)She developed project-based Learner Worksheets on Material Changes in the Form of Objects, while this study developed project-based Learner Worksheets on Single and Mixed Substances material.

Research conducted (Krismona Arsana & Sujana, 2021) entitled "Development of Project Based Learning-based Learner Worksheets in Science Content" Based on data analysis, the following results were obtained: (a) the results of the review of subject matter content experts show that Project Based Learning-based Learner Worksheets are very good with a percentage (92, 00%), (b) the learning design expert review shows the Project Based Learning-based Learner Worksheet is very good with a percentage of (93.00%), (c) the results of the learning media expert review show the Project Based Learning-based Learner Worksheet is very good with a percentage of (94.04%). This Project-Based Learning-based Learner Worksheet received very good qualifications based on the validation results. So, this Project-Based Learning-based Learner Worksheet meets the eligibility criteria for use. The difference between previous research and this research is that the research conducted by (Krismona Arsana & Sujana, 2021) developed project-based Learning-based student worksheets on Social Studies Content, while this study developed project-based Learning worksheets on Single and Mixed Substance materials.

Research conducted (Yulia Nuraini et al., 2023; Zang et al., 2022) Entitled "Development of Project Based Learning Worksheets (LKPD) to Improve Critical Thinking on Respiratory System Material in Human Grade V Elementary School" " based on data analysis, the results

obtained are as follows the results of the media expert review show that the Project Based Learning-based Learner Worksheet produces 100% validity, the learning design expert review shows a percentage (95%), the results of the learning language expert review show a percentage (92%) and revision according to suggestions. The teacher survey results show that most project-based Learning-based Learner Worksheets are practical, scoring 88%. The critical thinking ability test results on students got an average of 0.71 and 0.82, meaning there was an increase in the high category. Based on the results of the validation of the Project Based Learning-based Learner Worksheet to improve critical thinking on the material of the respiratory system in humans in grade V of this SD, it received very good qualifications. It met the criteria for feasibility of use. The difference between previous research and this research is that the research conducted by (Yulia Nuraini et al., 2023) She developed PJBL-Based Learner Worksheets to Improve Critical Thinking on Respiratory System Material in Humans. In contrast, this study developed Learner Worksheets Based on Project Based Learning to Improve Critical Thinking on Respiratory System Material in Humans.

Despite its potential benefits, the effectiveness of PjBL in elementary education is still under scrutiny, with studies showing inconclusive results and methodological flaws in assessing its impact on academic achievement (Ferrero et al., 2021). Teachers often face challenges such as lack of time, insufficient preparation in science content, and limited professional development opportunities, which can hinder the successful implementation of PjBL (Miller et al., 2015).

The urgency for developing PjBL worksheets stems from the need to improve student motivation and learning outcomes, particularly in science education, which is often sidelined due to curricular pressures to focus on subjects like English and mathematics (Miller et al., 2015). PjBL is recognized for its potential to enhance learning performance by actively engaging students in the learning process, as evidenced by its positive impact on student motivation and learning outcomes in various educational settings (Herlina, 2022).

The development of project-based learning (PBL) worksheets in elementary science education can significantly enhance student engagement and understanding. This research aims to refine existing methodologies and integrate innovative practices that align with contemporary educational needs. PBL worksheets encourage active participation, allowing students to explore scientific concepts through hands-on activities, which has been shown to improve learning outcomes significantly (Purwanto, 2023). The integration of technology, such as digital worksheets, can further engage students by providing interactive and accessible learning materials (Supriana et al., 2024).

Students are given effective learning to improve the quality and learning outcomes at school. Therefore, so that students are actively involved in education, especially in science lessons, teachers must find ways to increase effectiveness in teaching. This Project Learning-

based Learner Worksheet is very important to develop because the Learner Worksheet is designed to be as attractive as possible in the form of a picture book and can increase learning activeness.

METHODS

This study used a development research design or Research and Development (R&D). The research method used to produce new product designs, test the effectiveness of existing products, and develop and create new products is the definition of the development research method (R&D) (Sugiyono, 2019). The research and development model that researchers use is the ADDIE model, which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is a systematic approach that includes and divides the research planning system into several stages, arranges these stages into a logical sequence, and uses the output of each stage in the next stage (Rusmulyani, 2020).

The subjects of this research were grade V students of State Elementary School 140 Palembang, totaling 13 people, chosen for their relevance to the study's objectives and practical considerations. This non-random sampling method ensured that the selected students were representative of the target group for the educational material. The object of this research is teaching materials for Project Based Learning-based Learner Worksheets. The instruments used were validation sheets and practicality questionnaires. The validation sheet determines the product's suitability and is assessed by media, material, and language experts.

In the study, ADDIE model was employed through a structured process. Analysis involved identifying learning objectives and conducting a needs assessment to understand the challenges faced by Grade V students, as well as analyzing their characteristics and the educational context. During the Design phase, detailed outlines of the worksheets were created, including content structuring, instructional strategies, and assessment planning. The Development phase saw the creation of the worksheets, followed by expert reviews and pilot testing with a small group of students to refine the materials. In the Implementation stage, the worksheets were deployed in the classroom, with ongoing monitoring and feedback collection to ensure their effective use. Finally, the Evaluation phase included both formative and summative assessments to measure the worksheets' impact on student learning outcomes and make any necessary adjustments based on collected data and feedback.

The practicality questionnaire sheet is used to determine the product's practicality, and it is estimated by class teachers and fifth-grade students using the following formula. (Anggela et al., 2021) :

$$\text{Percentage} = \frac{total\ score}{maximum\ score} \text{ x } 100\%$$

The data collection techniques in this study were observation, questionnaire, and documentation. The data analysis techniques used are descriptive qualitative and quantitative analysis. For the study several data analysis techniques were employed. Qualitative descriptive analysis involved observing student interactions with the worksheets during trials and categorizing feedback from students and teachers to evaluate the worksheets' effectiveness and acceptance. Quantitative descriptive analysis included calculating validity percentages from expert assessments and practicality scores using a standardized formula from teacher and student questionnaires, with results categorized as "Very Practical" or "Practical." Student testing data from one-to-one and small group trials were analyzed to assess the impact on student motivation and understanding. Comparative analysis of validity, practicality, and feedback data was conducted to ensure consistency and identify improvement areas. Finally, impact analysis examined changes in student motivation, engagement, and comprehension to gauge the overall effectiveness of the worksheets.

RESULTS AND DISCUSSION

Results of Validation of Project-Based Learning Learner Worksheet

Table 1. Validation Test Results

Validators	Results	Category
Media	90,83%	Very Valid
Material	89,69%	Very Valid
Language	90,37%	Very Valid
Percentage	**90,29%**	**Very Valid**

Based on the table above, the final results of the validation test are obtained. From media validation, a percentage score of 90.83% was obtained with the category "Very Valid," material validation obtained a percentage score of 89.69% with the category "Very Valid," and language validation obtained a score of 90.37% with the category "Very Valid," it can be concluded that the teaching material for Project Based Learning Based Learner Worksheets (LKPD) in Science Learning received an overall percentage score of 90.29% with the category "Very Valid."

Practicality Results of Project-Based Learning Learner Worksheet

The stages carried out by researchers to obtain product practicality are two stages of experimentation. In the first stage, researchers tested the product's practicality with three students (one to one), and in the second, researchers tested the product's practicality with ten students (small group). Before the trial on students was carried out, the product was given to the class teacher, Mrs. Marliza Julianti, S.Pd, to find out the product's practicality. The results obtained in the practicality trial are as follows.

Table 2. Educator Response Results

No.	Aspect Assessment	Score
	Presentation Component	
1.	Is the material on the SWD by the Basic Competencies?	5
2.	Is the material on the LKPD by the learning indicators?	5
3.	Is the combination of colors and images on the LKPD attractive?	5
4,	Is the material on the LKPD complete and clear?	4
5.	Can the existence of this LKPD help the learning process at school?	5
6.	Can the use of this LKPD foster high student curiosity?	5
7.	Can the use of this LKPD increase students' learning motivation and focus	4
	Language	
8.	Is the language used in the LKPD clear and simple?	5
9.	Does the language used in the LKPD not contain a double or ambiguous meaning?	4
10.	Does the language used in the LKPD already use standard language	4
	Media Display	
11.	Does the design of the LKPD look attractive?	5
12.	Is the material design on the LKPD by the background and image?	5
13.	Is the size and type of font on the LKPD clear	4
14.	Is the color composition used in the LKPD appropriate and attractive	5
	Total	**65**
	Average	**92,85%**

Based on the table above, the results of the practicality test on the class teacher can be obtained with an average value of 92.85% with the category "Very Practical" so that the product can be used as teaching material in the classroom. Furthermore, the product was tested on three students (One to One).

Results of Learner Response to the One-to-One Test

From the results of the one-to-one trial, researchers received positive comments and responses about the products developed. Students are very interested in learning using the SWD; besides that, the SWD designed using the Project Learning learning model can increase learning motivation, improve critical thinking skills, and increase high curiosity. After the students had given their comments, they filled out a response questionnaire with the following results.

Table 3. Results of Learner Response to the One-to-One Test

No.	Name of Leaner	Assessment Aspect										Total	%	% Average
		Display			Presentation of Material				Benefits					
		1	2	3	4	5	6	7	8	9	10			
1.	Aditya Revano	5	5	4	4	5	5	5	5	5	4	47	94%	
2.	Fathir Alhadi	5	5	5	4	5	5	5	5	4	5	48	96%	**94%**
3.	Keisyah Zara	5	4	5	5	4	5	5	5	4	4	46	92%	

Based on the table of One to One trial results above, an average score of 94% was obtained with the category "Very Practical." Then next with the Small Group trial consisting of 10 students.

Results of Learner Response to the Small Group Test

The results of the Small Group trial also showed that researchers received positive comments and responses to the products developed. Students are very interested in learning using the LKPD; the LKPD, designed using the Project Learning learning model, can increase learning motivation, improve critical thinking skills, and increase curiosity.

Table 4. Results of Learner Response to the One-to-One Test

No.	Name of Leaner	Assessment Aspect										Total	%	% Average
		Display			Presentation of Material				Benefits					
		1	2	3	4	5	6	7	8	9	10			
1.	Asyfa Sauqiyah	5	4	4	5	5	4	4	5	4	5	45	90%	
2.	M.Aldi Saputra	5	4	5	5	4	4	5	4	5	4	45	90%	
3.	M. Fajar	4	3	5	4	4	5	5	4	4	5	43	86%	
4.	Nezha Leona	5	4	5	4	5	4	4	5	5	5	47	92%	
5.	Raden Dedi A	5	4	5	5	5	4	5	4	5	5	47	94%	
6.	Sukma Wijaya	4	5	5	5	5	5	5	5	5	5	49	98%	**93,2%**
7.	Trunantika Putri	5	4	5	5	5	5	5	5	4	5	48	96%	
8.	Maisya SShafira	5	4	5	5	5	4	4	5	4	5	46	92%	
9.	Zaskia Putri .S.	5	5	5	5	5	5	5	5	5	5	50	100%	
10.	R.M. Wico William	4	5	5	5	5	4	4	5	5	5	47	94%	

Based on the table of results of the Small Group trial above, an average value of 93.2% was obtained with the category "Very Practical."

Table 5. Practicality Test Results

Respondent	Value	Category
Educators	92, 85%	Very Practicality
Learners *(One to One)*	94%	Very Practicality
Learners *(Small Group)*	93,2%	Very Practicality
Percentage	**93,35%**	**Very Practicality**

Based on the table above, the final results of the product practicality test are obtained. From the educator's response, a percentage score of 92.85% was obtained in the "Very Practical" category; from the reaction of students (One to one), a percentage score of 94% was obtained in the "Very Practical" category and the results of the response from students (small group) received a score of 93.2% in the "Very Practical" category, it can be concluded that the

teaching material for Project Based Learning Based Learner Worksheets (LKPD) in Science Learning received an overall percentage score of 93.35% in the "Very Practical" category and is suitable for use in the learning process.

Discussion

This research is a research and development approach to produce new products that have not previously existed or improve existing ones. This research produces products as teaching materials for Project-Based Learning-based Learner Worksheets in Grade V Science Learning. This research refers to the ADDIE development model, which has five stages: Analysis, Design, Development, Implementation, and Evaluation. This development research aims to know the validity and practicality of the products developed.

The product is presented attractively and supports science learning, especially in Single and Mixed Substances material. The introduction of this product is expected to increase the motivation of students to learn, expand curiosity, and improve the critical thinking skills of students in the learning process. This study provides practical insights into how Project-Based Learning (PBL) worksheets can be implemented in the classroom to enhance the learning process. The findings support the development of more dynamic, project-based pedagogies that educators can employ to create more interactive and engaging learning experiences for students.

This is in line with research conducted by Elisa Septiana Dewi, Henni Riyanti & Patricia Lubis (Dewi et al., 2020) with the title "Development of Project Based Learning-based Learner Worksheets on Material Changes in the Form of Objects for Class V Elementary School" This study shows that the Project Based Learning Based Learner Worksheets developed is very valid. Based on the questionnaire sheet of media validation experts, material, and linguists with an average validity value of 86.84%. For practicality, an average value of 92.2% was obtained with very practical criteria. The researchers' discussion of the five stages of the ADDIE model that have been carried out is as follows:

Analysis Stage

At this stage, the researcher analyzes the problems that exist in SD Negeri 140 Palembang, especially in class V. The aim is that existing issues can be found for a solution and resolved immediately. At this stage, researchers analyzed students' needs and the material.

Design Stage

At this stage, the researcher designs the product to be developed. Researchers design products as attractive as possible to motivate students to learn. The following is a prototype design designed by researchers:

Figure 1. Learner Worksheet Display

Figure 2. Learner Worksheet Material Display

Development Stage

The third stage is product development or development; at this stage, the product will be tested for validity before being used or tested. Media experts, material experts, and linguists test this product validation for validity. After the validation assessment, the data will be further analyzed in the form of a questionnaire assessment score.

Table 6. Media Validator Revision Results

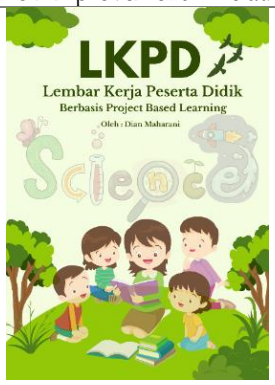
Before Revision	After Revision
	
Description of Improvement: The author added the Teaching Campus logo	
	
Description of Improvement: The author improves the appearance of the back cover; the cover is changed to plain / no writing	

Table 7. Revision Result Material Validator

Before Revision	After Revision
	
Description of improvement: The author revised the definition of a single substance and added chemical symbols for examples of elements and compounds.	

Table 8. Revision Result Language Validator

Before Revision	After Revision
	
Description of improvement: The author corrects the foreign language writing on the cover to be italicized "Project Based Learning."	
	
Remarks on improvement: Correct the writing of the bibliography according to the writing rules	

Implementation Stage

In the fourth stage, namely the implementation stage, the researchers tested the Project Based Learning Worksheet on Science Learning, which had been validated to fifth-grade students of Public Elementary School 140 Palembang to obtain the practicality of the product developed. The stages carried out by researchers to obtain product practicality are two stages of experimentation. In the first stage, researchers tested the product's practicality with three students (one to one). In the second, researchers tested the product's practicality with ten students (small group).

In the implementation stage, feedback from student testing plays a crucial role in refining and improving the Project-Based Learning (PBL) worksheets. This stage involves two key phases: individual (one-to-one) testing and small group testing, each providing unique insights into the product's effectiveness and practicality.

One-to-One Testing. During the first phase, the PBL worksheets were tested with three students individually. This setting allows for detailed, in-depth observations of each student's interaction with the worksheets. Researchers gather qualitative data on how students engage with the material, identify any challenges they face, and assess their understanding of the content. Feedback from this stage often highlights specific issues related to clarity, complexity, and student engagement. For instance, if a student struggles with a particular section of the worksheet or finds it confusing, researchers can pinpoint which elements need revision. Additionally, individual feedback provides insights into whether the worksheets meet the intended learning objectives and if any sections are redundant or missing key information.

Small Group Testing. The second phase involved testing the PBL worksheets with a small group of ten students. This phase offers a broader perspective on the worksheet's practicality and effectiveness in a more collaborative setting. It helps researchers observe group dynamics, how students work together, and how well the worksheets facilitate group discussions and problem-solving. Feedback from this stage often reveals whether the worksheets are engaging and practical for group work, if they encourage active participation, and if they successfully stimulate critical thinking and curiosity among students. It also helps identify any logistical issues, such as the time required to complete the worksheets or any difficulties in group coordination.

Impact on Revisions and Improvements. The feedback from both testing phases is instrumental in guiding revisions and improvements to the PBL worksheets. For instance, if individual testing reveals that students find certain instructions unclear, researchers can revise the wording or provide additional explanations. If group testing shows that collaborative activities are not effectively fostering teamwork, adjustments might be made to better facilitate group interactions. Additionally, feedback about the worksheets' overall design, such as visual appeal or layout, can lead to changes that enhance usability and engagement.

Feedback from the implementation stage is crucial for iterative development. It helps ensure that the PBL worksheets are not only theoretically sound but also practically effective in real classroom settings. By addressing specific issues identified during testing, researchers can refine the worksheets to better meet educational goals and improve the overall learning experience for students.

Evaluation Stage

The fifth stage is the evaluation stage. At this stage, the researcher evaluates what has been done from the initial to the last stage so that the developed product can function properly and is suitable for use in the learning process. Researchers also evaluate Project-Based Learning Learner Worksheets in Science Learning that have been developed based on expert comments,

suggestions, and responses from students and educators regarding the validity and practicality of the products produced.

The results of this study support research conducted by Elisa Septiana Dewi, kk (Dewi et al., 2020) The teaching materials for Project-Based Learning-based Learner Worksheets in Science Learning were developed to have valid and practical criteria for use in the learning process. In addition, this study also supports the results of research conducted by I Wayan Kristina & I Wayan Sujan. (Krismona Arsana & Sujana, 2021) Which states that the teaching materials for Project Based Learning Based Learner Worksheets developed are suitable for use as additional teaching materials because student worksheets have several advantages, among others, students are directed to be creative, students are required to think critically in solving problems in the Learner Worksheet, and the teacher is only a facilitator and student-centered learning so that the Project Based Learning Worksheet can be practically applied by teachers in the learning process.

CONCLUSION

This study focuses on the development of a Project-Based Learning (PBL) worksheet for fifth-grade elementary school science classes, specifically targeting the topic of Pure Substances and Mixtures. Based on the research findings, the developed worksheet has been demonstrated to be highly valid and practical for use in the learning process. Validation by media, content, and language experts yielded an overall validity score of 90.29%, categorized as "Very Valid." Meanwhile, practical testing by teachers and students indicated that the worksheet is highly practical, with an average score of 93.35%.

The development of the worksheet employed the ADDIE model, which comprises five stages: Analysis, Design, Development, Implementation, and Evaluation. During the Analysis phase, the researcher identified issues faced by students in understanding science material. In the Design phase, the worksheet was crafted with attention to the students' needs and characteristics to enhance their motivation and comprehension. The Development phase involved creating the worksheet and validating it through expert review. Implementation was carried out by testing the worksheet with students to assess its practicality and effectiveness. The Evaluation phase included final product assessment based on feedback and collected data.

The findings of this study indicate that the PBL-based worksheet developed can enhance student engagement and understanding in science learning, as well as stimulate their interest and critical thinking skills. Therefore, the use of this worksheet in science education is highly recommended to create a more interactive and engaging learning experience for students. These findings support the advancement of dynamic and relevant project-based pedagogy aligned with contemporary educational needs.

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