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Development of Learner Worksheets Based on PjBL Model to Increase Creativity on Material Changes in the Form of Objects

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ABSTRACT

Objective: Creativity is the ability of individuals to express themselves so that they will produce new ideas and works. Creativity can be enhanced by creating innovative learning activities that encourage students to express themselves and provide creative ideas so that students' creativity continues to increase. This study aims to determine the development of PjBL-based SW, its attractiveness, and increased student creativity. **Method:** This research (R&D) uses the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). **Results:** The results of this study indicate that 1) the product developed with the ADDIE model is declared "very valid." 2) PjBL-based SW obtained interesting results, and 3) PjBL-based SW has been proven to increase student creativity in a very creative category. **Novelty:** The novelty of this research is that the results of the independent thinking indicator are low when compared to other indicators, so these findings can be used as a basis for making research instruments on independent thinking for students' creativity.

INTRODUCTION

Learning activities in the classroom require superior creative and skilled human resources to produce an idea that can provide innovative work, so teaching materials are needed that can help students increase creativity (Azhari et al., 2024). Creativity is the curiosity to be able to develop inspiring ideas that exist in learners (Mardhiyah et al., 2021). Students need to be given the opportunity to express ideas and opinions of what they think (Fitriana et al., 2024). Based on the results of interviews conducted at Elementary School 1 Pandansari with teachers, they still have not implemented learning activities by linking the PjBL model using Student Worksheet (SW) due to limited knowledge in making SW, students have difficulty understanding the material on changes in the form of objects because learning still uses monotonous teaching materials, the creativity ability of students is still relatively low, and the lack of focus and attention of students due to less attractive teaching materials. This results in learners needing to be more confident and creative in bringing up their ideas. This results in students needing to be more confident and creative in expressing their ideas. Learning activities that are only teacher-centered reflect an inactive learning atmosphere so that creativity in students does not emerge because they are not given the opportunity to develop their ideas (Wasli, 2023).

Increasing creativity in learning can be done by using SW by involving students directly and methods in learning activities. SW is teaching material that contains short material, learning steps, and assignments given to students (Miranda et al., 2024). SW also guides students during learning activities (Wea et al., 2024). One learning model involving students directly is project-based learning (Puspita et al., 2023). A learning

A model is a way to implement a learning plan that has been prepared to achieve learning objectives (Hasibuan et al., 2024). The Project Based Learning (PjBL) model is a project-based learning method that involves students in learning activities that are carried out to increase creativity (Hasibuan & Hasibuan, 2023).

The PjBL learning model is innovative and student-centered learning. Learners are allowed to work together to construct their learning. Namely, learners design a problem and find solutions (Miftah et al., 2024). Hence, it increases students' creativity to develop solutions, making learning activities more meaningful and easily remembered (Astuti et al., 2019). Relevant learning activities linking problems to everyday life make it easier for learners to remember learning material (Astuti et al., 2019). Learning is memorable when it gets learners directly involved (Amelia et al., 2024), using interesting teaching materials (Adikalan et al., 2024) and fun learning (Salsadilla et al., 2024), meaningful and interactive learning (Muna et al., 2024). PjBL-based learning can provide experience and foster innovative ideas to improve their creativity (Yuniarti, 2021). Based on some of the above opinions, increasing students' creativity requires a PjBL-based SW that can help and be used as a guide for students in learning activities to foster innovative ideas and thoughts.

PjBL has characteristic features like 1) Learners make decisions about the framework, 2) There is a problem or challenge posed to learners, 3) Learners design the process to determine the solution to the problem or challenge posed, 4) Learners are collaboratively responsible for accessing and managing information to solve problems, 5) The evaluation process is carried out continuously, 6) Learners periodically reflect on the activities that have been carried out, 7) The end product of the learning activity will be evaluated qualitatively, 8) The learning situation is very tolerant of mistakes and changes (Khanifah, 2019).

The PjBL learning model has the following advantages: 1) Increasing learners' motivation to learn, encouraging their ability to do meaningful work and their need to be valued, 2) Improving problem-solving skills, 3) Making learners more active and successfully solving complex problems, 4) Increase collaboration power, 5) Encourage learners to develop and practice communication skills, 6) Improve learners' skills in managing resources, 7) Provide experience to learners learning and practice in organizing projects, and making allocations of time and other resources such as equipment to complete tasks, 8) Provide learning experiences that involve learners in a complex manner and are designed to develop by the real world, 9) Make the learning atmosphere fun, so that learners and educators enjoy the learning process (Nurhamidah & Nurachadijat, 2023).

The PjBL learning method has the following disadvantages: 1) Project-based learning requires much time to be set aside to solve complex problems, 2) Many parents of learners feel aggrieved because of the added cost of entering the new system, 3) Many instructors are comfortable with the traditional classroom, where the instructor takes the lead role in the class, 4) The amount of equipment that must be provided, therefore it is recommended to use team teaching in learning, 5) Learners have weaknesses in experiments and information gathering will experience difficulties, 6) There is a possibility that learners are less active in group work, 7) If the topic given to each group is different, there is a concern that students do not understand the topic as a whole (Bariyah & Sugandi, 2022). The weaknesses of PjBL can be overcome with the following steps or solutions:

1. Facilitate learners in dealing with problems.

2. Limiting learners' time to complete the project,
3. Minimize costs,
4. Provide simple equipment found in the surrounding environment,
5. Choosing a research location that is easy to reach,
6. Creating a pleasant learning atmosphere so teachers and students feel comfortable learning (Raini, 2021).

The learning related to this research is related to natural Science. Science is a science that studies natural symptoms or events. Science lessons must be taught early at the elementary school level. Activities are listening, recording, and seeing and doing with the scientific process. The science learning process can potentially train and develop creativity in students (Rahmayanti et al., 2024). Teachers provide freedom to express ideas to train students to solve problems or projects (Afdilla et al., 2024). This study uses creativity indicators of creativity skills, such as always wanting to get new experiences, having great curiosity, having a high imagination, independence in thinking, and a confident attitude (Marwiyati & Istiningsih, 2020).

Table 1. Correlation between PjBL and creativity indicators.

PjBL model syntax	Indicators of Creativity	Correlations
Determination of the fundamental question	Always looking to gain new experiences	Fundamental questions encourage learners to want to gain new experiences
Design a project plan	Great curiosity,	Planning activities arouse great curiosity in students
Developing a Schedule	Have a high imagination	From curiosity and encouragement to compiling a schedule or providing explanations related to the material, students' imagination will continue to increase.
Monitoring Learners and Project Progress	Independent in thinking	Learners will think independently during practical activities in learning, which can encourage self-confidence.
Testing Results and Evaluating Experiences	Confident attitude	In the final stage, namely, the attitude of confidence in the presentation of student results

(Amriani et al., 2024)

Based on Table 1, indicators with the PjBL syntax have a correlation that can increase students' creativity; this is supported by research by Aji et al. (2024), which states that student creativity will arise when teachers use methods that directly involve students in various projects or learning. Previous research has been conducted on developing project-based learning worksheets to improve critical thinking and social skills, while this research aims to increase student creativity. This research aims to describe the process of developing PjBL-based SW to increase creativity and describe the attractiveness and response of students in Science learning in elementary school.

RESEARCH METHOD

This research design uses the R&D method with the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The development

research procedure is the researcher's steps to develop the product. The ADDIE research and development model has five stages: analyze, design, develop, implement, and evaluate (Branch, 2010), which is made likely in Figure 1.

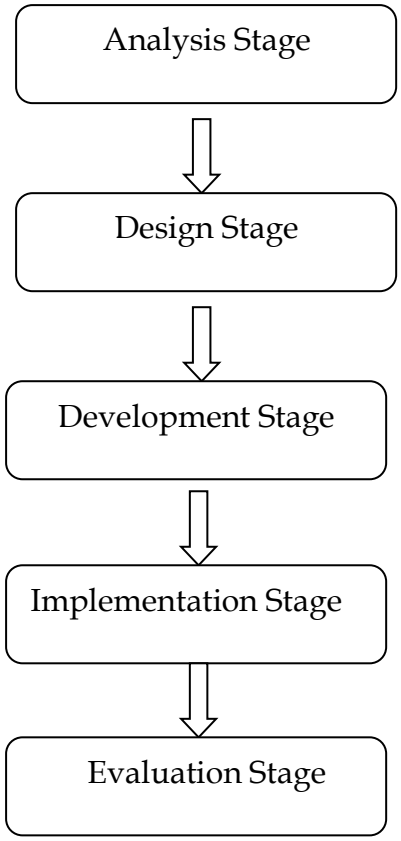

Figure 1. Research flowchart.

The working steps of the ADDIE model that will be used in this study are as follows:

1) Analysis Stage

The analysis stage is the stage where researchers analyze the need for product development and validity as well as the development requirements (Branch, 2010). The steps taken in the research and development of the analysis stage are:

Learner needs analysis is a questionnaire. It is an activity to identify the characteristics of students who are the target of the development of learning devices in order to obtain an overview of the problems faced by students related to the material, teaching materials used, and strategies used. Analyzing the needs of students is done by providing an observation sheet. This stage aims to find out the problems experienced by students during the science learning process.

2) Design Stage

The design stage in this study begins with designing research products in the form of PjBL-based SWs by considering learning objectives, subject matter, appropriate PjBL problems or scenarios, learning steps, and relevant assessments. Next, the SW assessment instrument will be compiled, and the SW components will be determined.

3) Development Stage

The development stage of learning devices is the preparation of SW components. The advice of experts such as material, language, and media experts will validate the resulting teaching material development products. Making SW using the Canva application requires software in the manufacturing process; Canva is used to create SWs with backgrounds and attractive images, then design validation, namely asking for suggestions and input from validators to get improvements from the media that has been made. Expert validation aims to determine the validity of the product. The product to be developed was validated by three validators and two product validation tests consisting of material, media, and language expert tests. The validator provides an assessment based on a questionnaire in the form of a scale provided by the researcher and provides suggestions for improvement on the test sheet provided; then, design improvements, namely after validation, the next stage is design improvement. Each question in the questionnaire is accompanied by five alternative answers with the scoring event following the scoring procedure with a Likert scale in Table 2.

Table 2. Likert scale for validator questionnaire

Criteria	Score
Highly Valid	5
Valid	4
Simply	3
Less Valid	2
Very Less Valid	1

(Astuti et al., 2021)

Likert scale formula:

$P = \frac{n}{N} \times 100$

Description:

P = Percentage level of aspects

n = number of scores obtained

N = maximum number of scores

The calculations and scores obtained can be seen from the validity criteria, which tell us what aspects of the assessment fall into what category. The data can then be seen from the categorization in Table 3.

Table 3. Validator validity categorization criteria.

Range	Category
V> 84%	Highly Valid
V> 68-84%	Valid
V> 52-68%	Fairly Valid
V> 36-52%	Less Valid
V≤ 36%	Invalid

(Riyani et al., 2017)

4) Implementation Stage

At the implementation stage, the products that have been validated and revised are then used to be tested directly in actual learning activities. Researchers implement SW in the context of learning Science in elementary schools. The implementation stage aims to test the practicality of the design of the SW based on the PjBL model. The implementation of the practicality test involved students in class V Elementary School 1 Pandansari, totaling 40 students. Researchers gave students a questionnaire to improve their creativity skills in the material of changes in the form of objects. The research was conducted in 2 classes, namely the experimental and control classes; in the experimental class, the developed product was used, while the control class did not use the product. This was done to measure the effectiveness of the product.

The results of the data calculation are then converted based on the criteria for evaluating the students' responses. The SW developed is declared practical if it obtains a percentage level of aspects > 61. The criteria for the practicality of learner responses can be seen in Table 4.

Table 4. Learner response questionnaire categorization criteria.

Category Value	Category Value
81-100	Very Interesting
61- 80	Interesting
41 - 60	Simply
21 - 40	Not Interesting
0 – 20	Very Unattractive

5) Evaluation Stage

The evaluation stage aims to evaluate the products developed at the ADDIE stage. In addition, field test results are improved for improvements contained in the SW to improve product quality and effectiveness and, thus, learning outcomes. Researchers use the creativity assessment categories in Table 5.

Table 5. Creativity assessment categories.

Score	Category
90-100	Highly Creative
75-89	Creative
60-74	Creative Enough
45-49	Less Creative
<45	Very Less Creative

(Usman, 2020)

RESULTS AND DISCUSSION

Results

The results of the study will be described as follows:

1. Analysis
   a) Needs analysis
      1) Educators still need to develop existing teaching materials; educators only use government teaching materials and stick to student books.

2) Educators must develop interesting SW so students are less active in learning activities.
3) Educators still need help to make SW.
4) Low student learning outcomes

b) Curriculum Analysis

2. Design

The initial product preparation involves designing PJBL-based SW to increase participants' creativity. Table 6 shows the result of the prototype that the researcher designed.

Table 6. Product design results.

No	Picture	Information
1.		The SW's cover contains the title, material to be discussed, classes, books for users, and the semester being run.
2.		Page 4, with the command let us read, contains the history of ice cream material related to social studies subjects contained in theme 7, subthemes 1

No	Picture	Information
3.		On page 5, there is an order to read so that students know when ice cream is beginning to arrive in Indonesia.

3. Development

The development stage is the result of the validation test used by expert lecturers; the following are the results of development that can be seen from material, media, and language experts:

1) Material Expert Validation Test

Material expert validation aims to get input on the accuracy of the material on the SW based on Project-Based Learning. The material expert validation assessment scores are in Table 7.

Table 7. Material expert validation assessment score.

No	Aspect Assessment	Index Percentage	Description
1	Curriculum	96%	Very Valid
2	Content	87%	Very Valid
3	Presentation	80%	Very Valid
4	Applicability	96%	Very Valid
	Holistic average	**89%**	**Very Valid**

The results of the material expert validator assessment, presented in Table 7, show that the curriculum, content, presentation, and implementation obtained 89% in the Very Valid category.

1) Media Expert Validation Test

Media expert validation takes the form of Project-Based Learner Worksheets, which aim to get input on the accuracy of the SW design so that it can increase student creativity. The media expert validation assessment score is in Table 8.

Table 8. Media expert validation assessment score

No	Score Assessment	Index	Description
1	Devices	90%	Very Valid
2	Visual communication	94%	Very Valid
3	Characteristics	80%	Very Valid
	Holistic average	**88%**	**Very Valid**

Based on the results of the assessment of media expert validators in Table 4.4, the device, visual communication, and characteristics obtained an average of 88% with a very valid description.

2) Language Expert Validation Test

The validation test on linguists in Project-Based Learning-Based Learner Worksheets aims to obtain input on language use and the suitability and correctness of writing good and correct Indonesian in the learning process, which is compiled based on Science.

Table 9. Language expert validation assessment score

No	Score Assessment	Index	Description
1	Directness	93	Very Valid
2	Language	93	Very Valid
3	Appropriateness to learner development	80	Very Valid
4	Use of terms and symbols	90	Very Valid
	Holistic average	**89**	**Very Valid**

The results of the linguist validator assessment presented in Table 8 show that clarity, language, suitability for student development, and the use of terms and symbols obtained an average of 89% with a very valid description. Based on the results of data analysis obtained from material, media, and language experts, the assessment score can be seen in Table 10.

Table 10. Expert validation assessment score.

No	Score Assessment	Index	Description
1	Material expert validation	89%	Very Valid
2	Media expert validation	88%	Very Valid
3	Language expert validation	89%	Very Valid
	Holistic average	**88%**	**Very Valid**

The holistic average results from material, media, and language experts were obtained with an index of 88% and a very valid description.

4. Implementation

The implementation stage aims to find out the respondents, namely educators, and students, to the SW developed and applied to actual conditions. The results obtained in the form of responses from educators who stated that the learner worksheets developed met the needs of students in learning activities in the classroom and the response of students to the product design, and it can be concluded that students need SW that can attract interest and make it easier for students to understand learning.

Table 11. Small group learner response.

Aspects	Average	Interpretation
Usage	86	Very Interesting
Usability	90	Very Interesting

Content Quality	89	Very Interesting
Holistic Average	**89**	**Very Interesting**

Based on Table 11 of students' responses in the small group, a holistic average of the aspects of use, usefulness, and content quality of 88 is obtained with the interpretation of "very interesting" so that PjBL-based SW products can be used in learning without revision. The following are the results of students' responses to using PjBL-based SW to increase students' creativity in learning science material changes in the form of objects in Table 12.

Table 12. Experiment with class student response.

Aspects	Average	Interpretation
Use of	89	Very Interesting
Usability	89	Very Interesting
Content Quality	88	Very Interesting
Holistic Average	**89**	**Very Interesting**

Based on Table 12, the data obtained from the student's responses on the aspect of using SW 89 interpretation is very interesting, usefulness 89 interpretation is very interesting, content quality 88 with very interesting interpretation with a holistic average of 89 interpretation is very interesting.

5. Evaluation

The evaluation stage is explained as a process carried out to provide value to the PjBL-based learner worksheets that have been developed. Evaluation can be done by looking at the effectiveness, normality, homogeneity, and difficulty tests on the SW used. The results obtained are based on the stages carried out so that it can be concluded that the PjBL-based learner worksheet to improve learner creativity is continued and developed. The following are the results of analyzing students through observation sheets to determine the creativity of students in learning Science in elementary schools who are given treatment with conventional learning and those given treatment using SW, which can be seen in Table 13.

Table 13. Observation sheet analysis of control and experiment classes

Aspects	ControlClass Experimental Class		Control Class Experimental Class	
	Average	Interpretation	Average	Interpretation
Always want to gain new experience	48	Less Creative	91	Very Creative
Great Curiosity	54	Less Creative	91	Very Creative
High Imagination	57	Less Creative	89	Creative
Independent in Thinking	56	Less Creative	88	Creative
Confident Attitude	49	Less Creative	89	Creative
Holistic Average	**53**	**Less Creative**	**90**	**Very Creative**

Based on Table 13, it can be seen that students have differences in their creativity. This difference can be proven by analyzing the validation sheet obtained data by the indicators used to increase students' creativity. From these data, it is known that there is a difference in the use of SW, which can increase the creativity of students, with a

holistic average of 53 control classes with less creative interpretation and a holistic average of 90 experimental classes with very creative interpretation.

Discussion

The development of PjBL-based SW was developed with ADDIE design (Analysis, Design, Development, Implementation, and Evaluation), at each stage carried out in accordance with the design basis used to produce a valid product for use in learning activities to measure the effectiveness of PjBL-based SW to increase the creativity of students who have been developed previously. In line with previous research that the creativity of learners will bring up ideas to improve students' creativity (Lestari et al., 2023), ideas (Muliani, 2022), creative work to develop personal competence to solve problems (Ridha et al., 2022).

PjBL-based SW is developed by compiling essential competencies up to the indicators used in the development process so that the development process requires valid testing. The PJBL model is one of the learning models that invites students to be involved in solving project problems (Fitriana et al., 2024); this makes students experience the process and build their knowledge in learning activities that are expected to increase student creativity to achieve practical goals (Novitasari et al., 2024). In line with the opinion of Dewi et al. (2024), creativity is the ability to produce ideas/products that have use value, where the results obtained from the project are creative ideas or synthesis of thoughts that include new patterns and combinations of information.

Testing by material, media, and language expert lecturers is carried out so that it is feasible to use in learning activities by obtaining criticism and valuable suggestions for improvements and enhancements to the developed SW. Validation is carried out with each average value getting 89% material expert validation, 88% media validation, and 89% language expert validation with a holistic average of 88% with a very valid category. The validity of the product was then tested by obtaining the results of students' responses to the use of PjBL-based SW to increase the creativity of students in learning science material changes in the form of objects in the experimental class with the treatment of using SW getting a holistic average of 89 with a very interesting category. Pjbl-based SW proved to increase students' creativity with a holistic average of the experimental class of 90% with a very creative category.

The findings in this study were obtained from the lowest value of one of the creativity indicators, namely the independent indicator in thinking of 88. Independence of thinking is an individual process of seeking initiative to plan, implement, and evaluate the learning system. Independence in thinking is independence in the learning process to solve a problem without help from others. Moreover, independence in thinking is the independence of individuals and the learning process where individuals can take the initiative to think to solve the difficulties faced (Tolla et al., 2024).

According to Paraniti et al. (2024), independent thinking can be learned, taught by teachers, and practiced continuously to create ideas so that students have independent thinking. Independence is one of the processes and efforts of a person to achieve learning goals, and students are required to be active so as not to depend on other people's thoughts (Amalia et al., 2024). Independence of thinking will be realized if students can develop ideas in thinking so that their creativity continues to increase (Sodik & Husniyah, 2024). From the description above, we know that independence of thinking is an indicator of creativity that requires students' role and ability to continue

developing ideas without dependence on others. Independence in thinking is the ability of individuals to be confident in conveying creative ideas so that projects or problems can be solved independently.

CONCLUSION

Fundamental Finding: Based on data analysis of research and development results with the title "Development of SW based on Prjoct Based Learning to increase student creativity" it can be concluded that: 1) The development of SW based on Project Based Learning to increase creativity developed with the ADDIE model is declared very valid based on material, media, language experts. 2) The response of students to the use of SW based on Project Based Learning to increase creativity is stated to be very interesting, as evidenced by the holistic average with a very interesting category. 3) PjBL-based SW is proven to be able to increase the creativity of students on the material of changes in the form of objects as evidenced by the holistic average before using SW categorized as less creative and the class that has been given SW treatment with a holistic average of 90.00 with a very creative category. **Implication:** Teachers can use SWs to increase students' creativity in science learning. Limitation: It is necessary to make more effective efforts or more innovative SW to increase the creativity of students in understanding Science learning material changes in the form of objects that are more efficient and conducive. **Limitation**: Educators can use PjBL-based SW to increase students' creativity. **Future Research:** For future researchers who will examine the development of PjBL-based SW to increase student creativity, it is hoped that they can expand the material in research or research**.**

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