Al-Ishlah: Jurnal Pendidikan
Vol.16, 4 (December, 2024), pp. 5805-5816
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v16i4.5740

Enhancing Critical Thinking in Elementary Students Through the Development Students Worksheet Using a Discovery Learning Approach

Siska Tresia Oktari[1], Ardipal[2]

[1] Universitas Negeri Padang, Padang, Indonesia; Tresiaoktarisiska@gmail.com
[2] Universitas Negeri Padang, Padang, Indonesia; Ardipalarly@gmail.com

ARTICLE INFO

Keywords:

Critical Thinking Ability;
Discovery Learning;
Student Worksheets

Article history:

Received 2024-07-25
Revised 2024-12-26
Accepted 2024-12-30

ABSTRACT

This study aimed to develop and evaluate Discovery Learning-based Student Worksheets (SW) to enhance critical thinking skills at the elementary school level. Addressing the need for innovative tools in education, the research assessed the validity, practicality, and effectiveness of these worksheets in improving student outcomes. A Research and Development (R&D) approach using the 4D model—definition, design, development, and deployment—was employed. The study was conducted in three elementary schools in West Sumatra. Data were collected through observation sheets, interview questionnaires, validation instruments, practicality questionnaires, and evaluation tests. The validity test of the SW yielded an average score of 89% (very valid), with media and material validity rated at 90% and 80%, respectively. Practicality tests showed an average score of 88.5% (very practical), based on teacher and student responses of 87% and 90%. Critical thinking test instruments demonstrated high validity, reliability, and appropriate levels of difficulty and discrimination. Implementation in two schools resulted in significant improvements in student outcomes, with an average N-Gain score of 0.74 (74.09%), indicating substantial enhancement in critical thinking skills. The findings highlight the SW's potential as an effective tool for fostering critical thinking at the elementary level. The results suggest that integrating Discovery Learning principles can significantly improve learning outcomes. The Discovery Learning-based SW was proven valid, practical, and effective. Future research should explore its application in diverse educational contexts and examine long-term impacts on critical thinking development.

Corresponding Author:
Siska Tresia Oktari
Universitas Negeri Padang, Padang, Indonesia; Tresiaoktarisiska@gmail.com

1. INTRODUCTION

Critical thinking is an essential skill in 21st-century education, particularly at the elementary school level, where foundational skills and competencies are cultivated. However, current educational tools, particularly Student Worksheets (SW), often fall short of fostering these critical skills. This research

addresses the inadequacies of existing SW and explores the development of Discovery Learning-based worksheets to enhance critical thinking abilities in elementary school students.

Education serves as a vital platform for human development, enabling individuals to realize their full potential through the acquisition of knowledge and skills (Neolaka, 2017). Schools, as formal learning institutions, hold a vital role in this process. At the elementary level in Indonesia, students are exposed to various fields of knowledge and equipped with fundamental skills to foster their development. To achieve these objectives, the government implements a curriculum designed to standardize and guide the educational process (Abdullah et al., 2023).

The Independent Curriculum represents a shift in curriculum development aimed at enhancing educational quality by aligning it with current demands. This curriculum promotes a student-centered approach, encouraging meaningful learning experiences and the development of competencies such as communication, creativity, and critical thinking (Barlian et al., 2022). Critical thinking, an advanced cognitive ability, encompasses logical reasoning, problem-solving, and decision-making, serving as an essential tool for addressing complex educational and real-life challenges (Anisa et al., 2023).

Science and Technology (IPAS) is a key subject in the Independent Curriculum, designed to foster critical thinking by integrating natural and social sciences. Its goal is to enable students to understand complex phenomena and develop strong analytical skills. Achieving these objectives requires effective learning tools, such as student worksheets (SW), which guide activities and encourage independent learning (Meini et al., 2017).

However, field observations at SDN 25 Koto Alam revealed significant deficiencies in the existing SW used by teachers. Many educators rely on publisher-produced worksheets that feature generic content disconnected from students' local environments. This lack of contextual relevance often leads to passive learning, where students are not actively involved in exploring concepts or applying critical thinking skills. Additionally, these SW lack structured guidance, interactive activities, and meaningful engagement, further limiting their effectiveness in promoting analytical thinking.

Furthermore, the worksheets often fail to meet established formatting standards, lacking clear instructions, implementation stages, and opportunities for students to document and analyze their findings (Azmi et al., 2018). Aesthetic shortcomings are another challenge; many SW rely on unappealing black-and-white designs that fail to capture students' interest. This is especially problematic for elementary school students, who are naturally drawn to colorful, visually engaging materials.

A critical limitation of the current SW is the type of questions included, which primarily consist of multiple-choice and short-answer formats. These questions largely assess rote memorization rather than encouraging higher-order thinking. As a result, students are rarely challenged to analyze, evaluate, or synthesize information—key skills necessary for critical thinking (Shanti Nur et al., 2018). To address these issues, there is an urgent need to develop more interactive, contextually relevant, and visually appealing SW that promotes critical and analytical thinking among students.

To address these issues, it is imperative to design SW that incorporate effective learning models such as Discovery Learning. This model emphasizes student exploration and active participation, enabling learners to construct knowledge independently. By aligning SW with Discovery Learning principles, educators can create tools that not only enhance student engagement but also promote critical thinking. This research aims to develop such worksheets, providing a practical solution to the limitations of current SW and contributing to the broader goal of improving educational outcomes in elementary schools.

According to Ennis (Nufus & Kusaeri, 2020), critical thinking involves several key activities: (1) understanding the problem, (2) providing reasons based on relevant evidence or facts, (3) making appropriate conclusions, (4) finding answers relevant to the context of the problem, (5) explaining or clarifying conclusions and complex terms, and (6) reviewing answers. These abilities are essential for students to develop, as critical thinking fosters independence, confidence, and the ability to solve problems wisely.

Despite its importance, existing educational tools, particularly Student Worksheets (SW), often fail to effectively promote critical thinking skills. Many current SW lack components that encourage active

student participation and higher-order thinking. This gap highlights the need for innovative approaches to worksheet development that integrate effective learning models and actively engage students in the learning process.

One promising solution is the development of SW based on the Discovery Learning approach. Discovery Learning encourages students to construct, organize, and apply ideas independently, fostering an active and student-centered learning environment. This approach enables students to generate, organize, and apply ideas effectively, as each step in Discovery Learning is designed to facilitate independent learning (Purwaningrum, 2016). By incorporating the principles of Discovery Learning, SW can more effectively support the objective of improving students' critical thinking abilities.

To bridge the identified gap, this research focuses on designing and validating Discovery Learning-based SW tailored to enhance critical thinking skills. These innovative worksheets are intended to provide structured guidance and opportunities for active student engagement, ultimately contributing to more effective learning outcomes.

2. METHODS

2.1 Research Design

This study employs the 4D model, encompassing four phases: Define, Design, Develop, and Disseminate. The research and development framework emphasizes the Preliminary Research Phase, Design Phase, and Implementation Phase.

1. Define: This stage involves identifying and understanding the problem. Preliminary research starts with a curriculum analysis to understand the needs and gaps in critical thinking skills among elementary school students.
2. Design: During this phase, the research design is formulated, including the planning of SW grounded in the Discovery Learning approach and the creation of materials aimed at improving students' critical thinking skills.
3. Develop: This stage focuses on producing and testing the SW product, refining it based on the feedback gathered during the trials.
4. Disseminate: The final stage involves implementing the product in real learning settings, evaluating its effectiveness, and disseminating the results to relevant stakeholders.

2.2 Subjects and Objects of the Study

The subjects of this research are fifth-grade students from SDN 25 Koto Alam, SDN 36 Kayu Pasak, and SDN 20 Gumarang. The focus of this study is the SW developed using the Discovery Learning approach, intended to enhance critical thinking skills in elementary school students. The choice of these schools was based on several important factors. Firstly, these schools demonstrated a commitment to educational innovation and expressed interest in implementing Discovery Learning approaches to enhance student learning outcomes. Additionally, the schools feature diverse student demographics, encompassing varying learning styles and abilities, which provide a broad context for evaluating the effectiveness of Student Worksheets (SW) based on Discovery Learning. The choice of fifth-grade students as the research subjects is particularly significant, as this grade represents a developmental stage where students are transitioning from concrete operational to more abstract thinking, as described in Piaget's theory of cognitive development. At this stage, students are increasingly capable of engaging in higher-order thinking processes, making them ideal participants for interventions aimed at enhancing critical thinking skills.

2.3 Data Collection Methods

The data collection techniques used in this research include:

1. Validation Sheets: To evaluate the quality and validity of the SW, material validators and language validators assess the content.

2. Questionnaires: These are administered to teachers and students to assess the practicality and effectiveness of the SW.
3. Evaluation Tests: Used to assess the effectiveness of the SW in improving students' critical thinking abilities.

The data types in this research include both qualitative and quantitative data:

- Quantitative Data: Data obtained from the questionnaires, including material and language validation, teacher and student practicality questionnaires, and evaluation tests.
- Qualitative Data: Feedback, including suggestions, criticisms, and responses from validators, teachers, and students, is used to refine and enhance the SW.

2.4 Data Analysis

The analysis of the data collected is conducted through several methods:

1. Validity Analysis

The validator analyzes all aspects of the SW based on the Discovery Learning approach. To find out the percentage use the formula and the results are interpreted based on the criteria shown in Table 1 (Sudijono, 2004):

$$P = f/N \times 100\% \quad (1)$$

Information :
P = Percentage numberrs
f = The frequency for which the percentage is being sought
N = *Number of Participants (Frequency count/number of individuals)*

Table 1. The validity level of the SW

Intervals	Category
< 20%	Invalid
21% - 40%	Not valid
41% - 60%	Fairly valid
61% - 80%	Valid
81% - 100%	Very valid

2. Practicality Analysis

Practicality analysis is seen in terms of design and readability. Students receive a questionnaire after the SW with the Discovery Learning approach is used in learning. The results are interpreted based on the criteria shown in Table 2.

$$P = f/N \times 100\% \quad (2)$$

Information :
P = Percentage numbers
f = The frequency for which the percentage is being sought
N = Number of Participants (Frequency count/number of individuals)

Table 2. The level of practicality of the SW

Intervals	Category
< 20%	Not practical
21% - 40%	Not practical
41% - 60%	Quite practical
61% - 80%	Practical
81% - 100%	Very practical

3. Effectiveness Analysis

a. Validity, Reliability, Difficulty Index, and Differentiating Power of Test Questions for Students' Critical Thinking Ability

Test equipment trials involve assessing the validity, reliability, difficulty level of question items, and their distinguishing power. The validity test is determined by calculating the product-moment coefficient using the formula:

$$rxy = \frac{N\sum X_1 Y - (\sum X_1)(\sum Y)}{\sqrt{\{N\sum X_1{}^2 - (N\sum X1)^2\}\{N\sum Y^2 - (\sum Y)^2\}}} \quad (3)$$

Information :

Rx : The correlation coefficient between individual item scores and the overall scores

N : Number of participants

∑X : Total item score

∑Y : Total score

∑XY: The frequency with which the item score is multiplied by the total score

∑x 2 : Sum of item squared scores

∑y 2 : Total squared score (Widoyoko, 2010)

Based on the calculation results above, they are then interpreted in the table as follows:

Table 3. Question Validation Test Criteria

r value	Interpretation
0.81 < r ≤ 1.00	Very high
0.61 < r ≤ 0.80	High
0.41 < r ≤ 0.60	Enough
0.21 < r ≤ 0.40	Low
0.00 < r ≤ 0.20	Very low

The reliability test was performed using the Cronbach Alpha coefficient formula, as the item scores to be evaluated were in the form of continuous (descriptive) questions. The formula for Cronbach's Alpha is:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma i^2}{\sigma i^2}\right) \quad (4)$$

Information:

$r11$: the reliability sought

$\sum \sigma i2$: the extent of variance in the scores for each item

$\sigma i2$: total variance

The results of the reliability test calculations are then interpreted based on the established reliability test criteria.

Table 4. Questions Reliability Test Criteria

r value	Interpretation
0.91 < r ≤ 1.00	Very high
0.71 < r ≤ 0.90	High
0.41 < r ≤ 0.70	Enough
0.21 < r ≤ 0.40	Low
0.00 < r ≤ 0.20	Very low

To find out the difficulty level of the questions, the questions are tested for their difficulty level. The formula used as a difficulty level test is:

$$P = \text{B/Js} \quad (5)$$

Information :
P : Level of difficulty
B : The overall number of students who provided the correct answer to the question.
Js : The overall number of students who participated in the test (Ahmad Sofyan, 2006)

The results of calculating the level of difficulty of the questions are then analyzed based on the criteria.

Table 5. Criteria for Difficulty Level of Question Items

Mark	Interpretation
0.00 – 0.30	Difficult problem
0.31 – 0.70	Medium problem
0.71 – 1.00	Easy question

To determine the differentiating power of a question, all test takers are grouped into two groups, namely group A with the highest score and group B with the lowest score. After dividing the students into two groups, the number of students in the upper group is labeled as JA, and the number in the lower group is also represented by JB. BA represents the number of students in the upper group who answered correctly, while BB refers to the number of students in the lower group who answered correctly. If these four values are known, the P value can be determined for each group in each question item using the following formula, and the results are interpreted based on the criteria shown in Table 6:

$$\text{PA = and PB=}\frac{BA}{JA}\frac{BB}{JB} \quad (6)$$

$$D = PA - PB \quad (7)$$

Information:
PA: Difficulty Index in group A
PB: Difficulty Index in group B
BA: The number of students in group A who provided the correct answer
BB: The number of students in group B who provided the correct answer
JA: Number of students taking the test in group A
JB: Number of students taking the test in group B

Table 6. Criteria for Differentiating Power of Questions

Mark	Interpretation
0.00 – 0.20	Bad
0.20 – 0.40	Enough
0.40 – 0.70	Good
0.70 – 1.00	Very well

b. Critical Thinking Ability Process Assessment

Analysis of observations of students' critical thinking ability processes obtained from students' answers before and after the learning process using SW. Before and after the learning process using SW refers to indicators of critical thinking, namely identifying, solving problems, analyzing, evaluating, and relating. Effectiveness testing was carried out using the N-Gain test, which evaluates the effectiveness of

the developed product in learning by measuring student learning outcomes. These outcomes are determined by the difference between the pretest and posttest scores. The pretest and posttest results are analyzed using the N-Gain score, which is calculated using the following formula:

$$N - Gain = \frac{Spost - Spre}{Smaks - Spre} \times 100 \quad (8)$$

Information :
Spost = Posttest score
Spre = Pretest score
Smax = Ideal maximum score (100)

The results of the calculations using the formula are then classified into N-Gain value categories, as presented in Table 7 below :

Table 7. N-Gain Score Evaluation Criteria

N-Gain Value	Category
n-gain ≥ 0.7	High
0.7 > n-gain ≥ 0.3	Currently
n-gain < 0.3	Low
N-Gain Value	Category

The results obtained are presented as percentages. These calculated results are then compared with the effectiveness assessment criteria, which are outlined in Table 8 below :

Table 8. Criteria for Learning Effectiveness

Percentage	Category
< 40	Ineffective
40 – 54	Less effective
55- 74	Effective enough
> 75	Effective

.

3. FINDINGS AND DISCUSSION

3.1 Definition Stage (Define)

At this planning stage, the researcher first carried out an analysis of the curriculum and student characteristics. The material "Let's Get to Know Our Earth" was used as the basis for developing Discovery Learning-based Student Worksheets (SW) for 5th-grade elementary school students. The material was chosen because it covers essential questions about diversity and change on earth. This material attracts students' attention because it discusses the concept of changes in the shape of the earth and the dynamics of environmental change. With Discovery Learning-based SW, students can be actively involved in exploration and problem-solving, stimulating their critical thinking abilities. This material also responds to students' curiosity about the world around them. Through reflective questions, students are invited to understand why the shape of the earth changes and how the environment experiences transformation over time. The selection of this material aims to create an interesting, motivating, and empowering learning experience for students to be more active in exploring basic scientific concepts about the Earth. With this approach, it is hoped that students can develop a deep understanding of their environment and feel involved in understanding the complexity of the world around them.

Researchers also analyzed the characteristics of students before making plans to develop SW. According to preliminary studies that have been carried out, students tend to only use source books

which do not accommodate all students. Students never use a variety of learning media in terms of improving critical thinking skills and do not have a greater desire to understand learning material, especially social integration material.

3.2 Planning Stage (Design)

At this stage, the researcher begins to prepare the SW format which is sourced from each analysis data in the preliminary study, and creates a validation sheet that will be given to assess the feasibility and effectiveness of the SW that will be developed. The validation sheets created by researchers are media validation sheets, material validation sheets, and particularity questionnaire sheets which will be given to teachers and students.

3.3 *Development Stage (Develop)*

3.3.1 Validation of SW

In this stage, the SW is validated by media and material experts. The validation results of the SW developed by the researchers, based on the validation instruments assessed by the experts, are as follows:

Table 9. SW Validation Results

No	Validator	Average	Category
1	Media Expert	90%	Very Valid
2	Materials Expert	88%	Very Valid
Average		89%	Very Valid

The validation results indicated that the developed SW is highly valid across both media and material aspects. It was subsequently implemented in the learning process at SDN 36 Kayu Pasak and SDN 20 Gumarang, confirming its suitability for enhancing the learning experience

3.3.2 Practicality Test

After the learning process using Discovery Learning-based SW is complete, practicality questionnaires are distributed. At this stage, the practicality of the SW is assessed by the class teacher and class V students from SDN 36 Kayu Pasak and SDN 20 Gumarang. The results of the SW practicality test, developed by the researchers, based on the validation instrument outcomes, are as follows:

Table 10. Practicality Test Results

No	Type of assessment	Average	Category
1	Teacher response	87%	Very Practical
2	Student response	90%	Very Practical
Average		88.5%	Very Practical

The practical evaluation indicates that the developed SW is highly practical for both teachers and students, thereby demonstrating its effectiveness in facilitating the learning process.

3.3.3 Effectiveness test

Validity, Reliability, Discriminating Power and Difficulty Index

The critical thinking ability test instrument consists of 5 essay questions based on the material "Let's Get to Know Our Earth.". These questions are administered before learning (pre-test) and after learning (post-test) at both the trial and implementation elementary schools. The following data was obtained based on the test instrument results :

Table 11. Recapitulation of Data Analysis of Critical Thinking Ability Test Evaluation Results.

No	Test Questions	Question				
		1	**2**	**3**	**4**	**5**
1	Validity	0.81	0.81	0.78	0.79	0.77
	Category	High	High	High	High	High
	Criteria	Valid	Valid	Valid	Valid	Valid
2	Reliability	0.88	0.88	0.88	0.88	0.88
	Category	High	High	High	High	High
3	Differentiating power	0.423	0.416	0.435	0.412	0.447
	Category	Good	Good	Good	Good	Good
4	Difficulty index	0.55	0.47	0.43	0.43	0.48
	Category	Currently	Currently	Currently	Currently	Currently

Based on the table above, it can be seen that the validity of questions for numbers 1, 2, 3, 4, and 5 meets the high category with valid criteria. Meanwhile, reliability is in the high category. The differentiating power of numbers 1, 2, 3, 4, and 5 is in the good category. The difficulty index for numbers 1, 2, 3, 4, and 5 is in the medium category. Based on the results of the critical thinking ability test, it can be concluded that the test instrument for critical thinking is valid and can be used in the research.

Learning Results and N-Gain Test

After analyzing the critical thinking ability instrument, an analysis of student learning outcomes at the implementation elementary schools, namely SDN 36 Kayu Pasak and SDN 20 Gumarang, was carried out. The Maximum Completeness Criteria (MCC) at both schools is set at 80, meaning students who score ≥ 80 are considered successful in that topic. The following is a summary table of student learning outcomes for each school:

Table 12. Summary of Student Learning Outcome Scores

No	School name	Pre-test	Post-test	KKM
1	SDN 36 Kayu Pasak	49.25	87.75	80
2	SDN 20 Gumarang	48.15	85.65	80
Average		48.70	81.70	

Based on the analysis, students' learning outcomes at SDN 26 Kayu Pasak and SDN 20 Gumarang demonstrated significant improvement from pre-test to post-test, reflecting a notable increase in learning achievement. To evaluate the enhancement of critical thinking skills and the effectiveness of the developed SW, an analysis of the average N-Gain data was conducted :

Table 13. N-Gain Test Analysis Results

Component	N-gain	Improvement category	N-Gain Score (%)	Category
SDN 36 Kayu Pasak	0.75	High	75.86	Effective
SDN 20 Gumarang	0.72	High	72.32	Effective
Average	0.74	High	74.09	Effective

The N-Gain test analysis indicates that the SW, based on the Discovery Learning approach, is highly effective and successful in improving learning outcomes. These findings confirm the validity, practicality, and effectiveness of the developed SW.

Discussion

This study explores and creates Student Worksheets (SW) based on the Discovery Learning model for elementary school students, aiming to improve their critical thinking skills. The Discovery Learning-based SW is crafted to encourage independent learning through an engaging and meaningful approach. The findings of this study are supported by previous research, such as studies conducted by (Kyriazis et al., 2019), which shows that learning through the Discovery Learning model, supported by SW, can enhance students' academic performance.. In addition (Sofeny, 2017) stated that there is a greater impact on extroverted students compared to introverted students when using the Discovery Learning model in writing activities

The selection of the material " Let's Get to Know Our Earth " is based on an evaluation of the scope of the material, which includes concepts of the Earth's shape changes and environmental dynamics. Based on curriculum analysis and student characteristics, it was found that this material could spark students' interest in their surrounding environment and make it easier for teachers to provide reflective questions to students. Furthermore, the selected material is highly suitable for developing SW based on Discovery Learning, where students can actively engage in exploration and problem-solving, thus stimulating their critical thinking abilities. The SW based on Discovery Learning developed contains learning materials presented in an engaging manner, supported using images, clear fonts, and symbols or icons that match the material.

This research found that the validation of the SW based on Discovery Learning was highly valid, with an average score of 89%, with the media and material aspects receiving scores of 90% and 88%, respectively. These results support the research objective of developing a learning aid that can be used effectively in the classroom. The appealing design, student-friendly language, and consistent application of the Discovery Learning model steps make it easier for students to engage actively in learning activities. These findings support the hypothesis that Discovery Learning-based SW can enhance students' critical thinking skills.

The practicality test of the SW showed an average score of 88.5%, with teacher responses at 87% and student responses at 90%. This affirms that the SW based on Discovery Learning makes it easier for students to acquire information, build learning concepts, and increase their involvement. This finding is consistent with the research of (Octaviani, 2020), which also found that SW based on Discovery Learning significantly increased student engagement and understanding. In addition, in research (Akbar, 2018) with the research title "Development of Student Worksheets Based on Discovery Learning for MTSN Stabat TP 2017/2018 Students" with practical learning results meeting practical criteria based on the average score of the student response questionnaire of 91.5% with very good criteria. However, our study expands on this knowledge by offering further evidence in the context of elementary school students. It demonstrates that the use of Discovery Learning-based SW not only receives high practicality ratings from both teachers and students but also consistently yields positive effects on critical thinking skills and learning outcomes.

The critical thinking skills test instrument demonstrated high validity and reliability, strong discrimination power, and a moderate level of difficulty. The SW based on Discovery Learning encourages students to formulate hypotheses based on the questions posed, thereby enhancing their critical thinking abilities. This finding builds upon existing research by not only confirming that Discovery Learning increases student engagement but also directly improves their critical thinking skills. While previous studies, such as (From & Taufina, 2021), have shown that Discovery Learning model is recognized for its effectiveness in enhancing students' critical thinking, our research expands on this by offering evidence that Discovery Learning can significantly boost critical thinking skills in elementary school students

The application of Student Worksheets (SW) based on Discovery Learning significantly improved student learning outcomes, with an average N-Gain score of 0.74 and a percentage of 74.09%. These results were consistent across two applied schools (SDN 36 Kayu Pasak and SDN 20 Gumarang), with N-Gain scores of 0.75 and 0.72, respectively. These findings provide strong evidence of the effectiveness

of SW based on Discovery Learning in enhancing student learning outcomes. While previous research, such as (Wahyudi et al., 2019), demonstrated an improvement in learning outcomes after using Discovery Learning-based SW, our study extends this knowledge by providing further evidence of its effectiveness across different elementary school contexts. Additionally, our study highlights that the improvement in learning outcomes is not only reflected in academic performance but also in the enhancement of critical thinking skills, which aligns with the primary goal of this research.

This research provides growing evidence that the use of Discovery Learning-based educational tools can significantly enhance critical thinking skills among elementary school students. Furthermore, this study demonstrates that Discovery Learning-based SW is a practical and effective approach for teachers to enhance students' critical thinking skills. The key contribution of this research is the development of a learning tool that is both engaging and successful in promoting the growth of critical thinking skills among elementary students. Future research could broaden its scope to include a variety of subjects, grade levels, long-term effects, and more effectively cater to the diverse learning styles of students.

4. CONCLUSION

The research findings indicate that the Discovery Learning-based student worksheets (SW) developed in this study exhibit high validity, practicality, and effectiveness. The critical thinking test instrument embedded within the SW proved to be a reliable tool for assessing students' critical thinking skills, demonstrating strong validity, reliability, and discriminating power. Furthermore, the SW significantly enhanced students' critical thinking abilities, as reflected in improved learning outcomes following its implementation. This research underscores the potential of Discovery Learning-based SW in fostering critical thinking and improving educational quality. However, the study is limited to short-term impacts within a specific educational context. Future research could explore the long-term effects of Discovery Learning-based SW on student outcomes, investigate its application in diverse educational settings, and analyze the role of factors such as teacher training, classroom dynamics, and student demographics in influencing the effectiveness of this approach. Such investigations would provide deeper insights into optimizing the use of Discovery Learning to support critical thinking and learning across varied contexts.

REFERENCES

Abdullah, A. A., Ahid, N., Fawzi, T., & Muhtadin, M. A. (2023). Peran Guru dalam Pengembangan Kurikulum Pembelajaran. *Tsaqofah*, *3*(1), 23–38. https://doi.org/10.58578/tsaqofah.v3i1.732

Akbar, I. (2018). *Pengembangan Lembar Kerja Peserta Didik Berbasis Discovery Learning Pada Siswa MTsN Stabat T.P 2017/2018.*

Anggita, A. D., Ervina Eka Subekti, Muhammad Prayito, & Catur Prasetiawati. (2023). Analisis Minat Belajar Peserta Didik Terhadap Pembelajaran Ipas Di Kelas 4 Sd N Panggung Lor. *Inventa*, *7*(1), 78–84. https://doi.org/10.36456/inventa.7.1.a7104

Anisa, S., Nirmalasari, E., & Madiun, U. P. (2023). *Pengaruh Model Pembelajaran Project Based Learning Ditinjau Dari Kemampuan Berpikir Tingkat Tinggi Terhadap Hasil Belajar Ipa Kelas IV SDN 02 Manisrejo*. *2*(2), 399–405.

Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.

Azmi, N., Prastowo, P., & Maslena, M. (2018). Analisis Kesesuaian Lembar Kerja Peserta Didik (SW) Biologi Kelas X Yang Digunakan Man Rantauprapat Kabupaten Labuhan Batu. *Jurnal Pelita Pendidikan*, *6*(2), 65–70. https://doi.org/10.24114/jpp.v6i2.10140

Baharudin dan Wahyuni. (2008). *Teori Belajar dan Pembelajaran*. Ar-Ruzz Media Group.

Barlian, U. C., Solekah, S., & Rahayu, P. (2022). Implementasi Kurikulum Merdekadalam Meningkatkan

Mutu Pendidikan. *Journal of Educational and Language Research*, *1*(12), 2105–2118.
Chairul Anwar. (2017). *Teori-Teori Pendidikan Klasik Hingga Kontemporer (Cet 1)* (IRCISOD (ed.)).
Dari, O. W., & Taufina, T. (2021). Penerapan Model Problem Based Learning (PBL) Pada Pembelajaran Tematik Terpadu di Kelas V Sekolah Dasar (Studi Literatur). *Jurnal Inovasi Pendidikan Dan Pembelajaran Sekolah Dasar*, *4*(1), 98. https://doi.org/10.24036/jippsd.v4i1.109461
Krismayoni, P. A. W., & Suarni, N. K. (2020). Pembelajaran IPA dengan Model Pembelajaran Children Learning In Science Meningkatkan Hasil Belajar Ditinjau Dari Minat Belajar. *Jurnal Pedagogi Dan Pembelajaran*, *3*(2), 138. https://doi.org/10.23887/jp2.v3i2.25258
Kyriazis, A., Psycharis, S., & Korres, K. (2019). Discovery Learning and the Computational Experiment in Higher Mathematics and Science Education: A Combined Approach. *International Journal of Emerging Technologies in Learning*, *4*(4), 25–34.
Lubis, A., & Sukmawarti, S. (2022). Pengembangan SW Berbasis Discovery Learning Pada Tema Panas Dan Perpindahannya Subtema Suhu Dan Kalor Kelas V Sekolah Dasar. *Jurnal Penelitian Pendidikan MIPA*, *6*(6), 1–7.
Luh, N., & Ekayani, P. (2021). Pentingnya penggunaan media siswa. *Pentingnya Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Siswa*, *March*, 1–16.
Meini, M., Hasanuddin, H., & Djufri, D. (2017). Pengaruh pembelajaran berbasis SW konstruktivistik terhadap hasil belajar kognitif siswa pada konsep makanan dan sistem pencernaan di sma negeri 12 …. *Jurnal Edubio Tropika*, *5*(April), 33–37.
Munawaroh, I. (2015). *Urgensi Penelitian dan Pengembangan*. Universitas Negeri Yogyakarta.
Neolaka, A. N. dan G. A. A. (2017). *Landasan Pendidikan Dasar Pengenalan Diri Sendiri Menuju Perubahan Hidup*. Kencana.
Nufus, H., & Kusaeri, A. (2020). Analisis Tngkat Kemampuan Berpikir Kritis Siswa Dalam Memecahkan Masalah Geometri. *Jurnal Pendidikan Matematika Indonesia*, *5*(2), 49–55.
Nurmayani, L., Doyan, A., & Verawati, N. N. S. P. (2018). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Pendidikan Fisika Dan Teknologi*, *4*(1), 98–104. https://doi.org/10.29303/jpft.v4i1.548
Oktaviani, R. E. (2020). *Pengembangan Lembar Kerja Peserta Didik Berbasis Discovery Learning Untuk Meningkatkan Kemampuan Berfikir Kritis Peserta Didik Kelas V Sekolah Dasar*. Universitas Islam Negeri Sultan Syarif Kasim.
Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613
Riduwan. (2005). *Skala Pengukuran Variable Penelitian*. Alfabeta.
Shanti Nur, W., Alin Sholihah, D., & Anis Abdullah, A. (2018). Meningkatkan kemampuan berpikir kritis melalui ctl. *Jurnal Elektronik Pembelajaran Matematika*, *5*(1), 98–110. http://jurnal.uns.ac.id/jpm
Sofeny, D. (2017). The Effectiveness of Discovery Learning in Improving English Writing Skill of Extroverted and Introverted Students. *Jurnal Penelitian Humaniora*, *18*(2), 41–46.
Sudijono, A. (2004). *Pengantar Statistik Pendidikan*. Raja Grafindo Persada.
Sudrajat, A.A & Surbakti, A. (2017). *Pengembangan SW Tematik berbasis Problem Based Learning pada Materi Peninggalan-Peninggalan Kerajaan Islam di Indonesia untuk Kelas V SD*.
Wahyudi, R., Rukmini, D., & Bharati, D. (2019). Developing a Discovery Learning Based Assessment Module to Stimulate Critical Thinking and Creativity of Students' Speaking Performance. *English Education Journal*, *9*(2), 172–180.
Widoyoko, E. P. (2010). *Evaluasi Program Pembelajaran*. Pustaka Pelajar.