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Development of Student Worksheets Based on Discovery Inquiry and Fun Learning to Enhance Creative Thinking and Learning Independence

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Abstract:
Learning in elementary schools still tends to be teacher-centered, so it is not yet optimal in fostering students' creative thinking skills and learning independence. This study aims to develop and analyze the effectiveness of Student Worksheets based on Discovery Inquiry and Fun Learning in improving creative thinking skills and learning independence of elementary school students. The research was conducted at the Diponegoro Cluster Elementary School, Kembaran Subdistrict, Banyumas Regency, using the Research and Development (R&D) method in the Borg and Gall model. The research subjects were elementary school students, with qualitative data analysis techniques for feasibility testing and quantitative analysis using the t-test, specifically the independent sample t-test. The results showed that the Student Worksheets based on Discovery Inquiry and Fun Learning were deemed feasible by material experts and media experts. In addition, Student Worksheets based on Discovery Inquiry and Fun Learning have been proven effective in enhancing students' creative thinking skills and learning independence, especially in high and medium ability groups. Therefore, Student Worksheets based on Discovery Inquiry and Fun Learning can serve as an alternative, innovative teaching material that supports active and student-centered learning in elementary schools.

Abstrak:
Pembelajaran di sekolah dasar masih cenderung berpusat pada guru sehingga belum optimal dalam menumbuhkan keterampilan berpikir kreatif dan kemandirian belajar peserta didik. Penelitian ini bertujuan untuk menghasilkan dan menganalisis keefektifan Lembar Kerja Peserta Didik berbasis Discovery Inquiry dan Fun Learning dalam meningkatkan kemampuan berpikir kreatif dan kemandirian belajar peserta didik sekolah dasar. Penelitian dilaksanakan di Sekolah Dasar Gugus Diponegoro, Kecamatan Kembaran, Kabupaten Banyumas dengan menggunakan metode Research and Development (R&D) model Borg and Gall. Subjek penelitian adalah siswa sekolah dasar, dengan teknik analisis data kualitatif untuk uji kelayakan dan analisis kuantitatif menggunakan uji-t, yaitu independent sample t-test. Hasil penelitian menunjukkan bahwa Lembar Kerja Peserta Didik berbasis Discovery Inquiry dan Fun Learning dinyatakan layak oleh ahli materi dan ahli media. Selain itu, Lembar Kerja Peserta Didik berbasis Discovery Inquiry dan Fun Learning terbukti efektif meningkatkan keterampilan berpikir kreatif dan kemandirian belajar

siswa, terutama pada kelompok kemampuan tinggi dan sedang. Dengan demikian, Lembar Kerja Peserta Didik berbasis Discovery Inquiry dan Fun Learning dapat menjadi alternatif bahan ajar inovatif yang mendukung pembelajaran aktif dan berpusat pada peserta didik di sekolah dasar.

Keywords:
Student Worksheet, Discovery Inquiry, Fun Learning, Creative Thinking, Learning Independence

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INTRODUCTION

Over the past few years, the limited creative thinking skills and learning independence of elementary school students have become a significant concern in Indonesia's education system. According to the 2024 Education Quality Report from the Diponegoro Cluster, Kembaran District, Banyumas Regency, the average creative thinking score of students was 53.19, categorized as lower-middle at both the district and national levels. Similarly, the affective aspect of learning independence scored 52.37, also in the lower-middle category. This issue reflects a broader national challenge; the Balitbang Kemendikbud reported that Indonesian students' creative and problem-solving abilities remain below the OECD average in the PISA assessment, particularly in mathematics.

These findings highlight the urgent need to strengthen 21st century competencies creativity, critical thinking, collaboration, and independence through the implementation of the Merdeka Curriculum and the Pancasila Student Profile, which emphasize character and holistic learning. However, classroom observations and teacher interviews in the Diponegoro Cluster indicate that the use of conventional Student Worksheets remains limited to single sheet exercises, failing to engage diverse learners or foster higher order thinking.

In accordance with curriculum and government policies, the importance of mastering soft skills in the 21st century (Afandi, Sajidan, Akhyar, & Suryani, 2019), is emphasized, including character, citizenship, critical thinking, creativity, collaboration, and communication. The

development of these abilities is achieved with a quality strategy in line with the current curriculum, namely the Merdeka curriculum, with the implementation of the Pancasila student profile as part of instilling 21st century character to prepare students to face future challenges.

The right strategy includes effective and innovative interactions between students and educators. The teaching methods adopted by teachers influence the effectiveness of the proposed program (Fakhrou & Ghareeb., 2020). This is in line with Permata, Roza, and Maimunah (2021), learning tools that can help and facilitate teaching and learning activities can form an effective interaction between students and educators, one of which is the Student Worksheet. The importance of the Student Worksheet for students is as a tool to build their knowledge, where the Student Worksheet is part of the teaching materials as a learning resource, which is one of the important factors that can determine the success of a learning process (Hadju, Abdjul, Yusuf, & Odja, 2023).

Creative thinking and independence support each other in the learning process (Marniati & Yuliani, 2021). Creativity plays a central role in the preschool curriculum and is commonly understood as a process through which individuals generate novel and original ideas or products (Dere, 2019). Independence encourages students to actively manage their own learning process, from identifying needs to evaluating learning outcomes, while creative thinking allows them to generate new ideas and innovative solutions independently. As emphasized by Kusyanto, Shahrill, Irwan, and Yazid (2022) Students need to be accustomed to learning to provide new opinions or ideas that make students creative in solving problems independently. Independence is the key for students to be able to convey their ideas in the process of achieving their learning success.

Creative thinking is divergent thinking. According to Mayarni and Yulianti (2020) , there are four indicators of creative thinking skills, namely: (1) Fluency, where students can generate various ideas or solutions to a problem; (2) Flexibility, which is characterized by the ability of students to provide various solutions; (3) Originality, which is reflected in the ability of students to create new and unique ideas; and (4) Elaboration skills, which are reflected in the ability of students to develop ideas in detail and depth. Furthermore, according to Ririn, Budiman, and Muhammad (2021), effective and relevant indicators of student learning independence, used to assess the level of student learning independence include: (1) not depending on others, (2) responsibility,

(3) having initiative, (4) discipline in completing tasks, and (5) being confident with the answers given in the learning process until evaluation.

Sharpening creative thinking skills can be done by facing problems in mathematics lessons. However, currently, mathematics is sometimes considered difficult and scary, even though mathematics is one of the compulsory subjects that has an important role in everyday life as a basic science, as a provision for 21st-century skills in facing today's global challenges. Mathematics is a subject whose knowledge is obtained through the process of thinking (reasoning) (Muhlisah, Misdaliana, & Kesumawati, 2023). Developing students' critical and creative thinking skills is the main goal of mathematics education (Syam, 2020). Supported by research Aprima and Sari (2022), the application of differentiated learning in elementary school mathematics learning content is considered very effective.

Differentiation can help the Pancasila Student Profile in the Merdeka curriculum in developing a profile of faith, independence, cooperation, global diversity, critical and creative reasoning, so that differentiated learning is very appropriate for independent learning (Wahyuningsari, Mujiwati, Hilmiyah, Kusumawardani, & Sari, 2022). Differentiated learning is a way of thinking that views each student as unique and needs different handling from one another (Nawati, Yulia, & Khosiyono, 2023). This differentiated learning is highly recommended to be implemented in class by every teacher at every level (Dalila, Rahmah, Liliawati, & Kaniawati, 2022). According to Avivi, Pramadhitta, Rahayu, Saptariana, & Salamah (2023), differentiated learning practices are important to share because differentiated learning can accommodate the diversity of abilities and characteristics of students.

The results of the initial study on the report card of the quality of education at SD Gugus Diponegoro, Kembaran District, Banyumas Regency, in 2024, on the quality of learning, which includes cognitive and affective assessments. Of the 11 elementary schools, 9 schools experienced a decline. The cognitive aspect, especially the aspect of creative thinking skills, has an average score of 53.19, which is included in the lower middle ranking category, both at the Regency and National levels. Then there is an affective aspect that is low compared to other affective aspects, namely independence, with an average score of 52.37 in the lower middle ranking category at the Regency and National levels.

Based on the results of interviews with four elementary school teachers in the Diponegoro Cluster, Kembaran District, although differentiated learning

has been implemented, its implementation at the elementary school level still faces challenges. Some of them are: (1) The Student Worksheet presented is still in the form of a simple single sheet, causing variations in student responses; some immediately work on it, while others are less interested. As a result, the work is not simultaneous, extending the learning time and disrupting the schedule that has been set. (2) The Student Worksheet currently used has not been designed to accommodate the diversity of student abilities. This causes some students to have difficulty following the learning, while others feel less challenged, so that their learning potential does not develop optimally.

Previous research by Handayani & Koeswanti (2021) argued that the effectiveness of learning activities largely depends on teachers' ability to select instructional models that are aligned with the learning content, thereby fostering students' learning autonomy and creative thinking skills. Among various types of learning media, Student Worksheet play a crucial role because they guide students through structured yet flexible learning activities that stimulate curiosity, encourage experimentation, and promote deeper analysis. A well designed student worksheet can present open ended questions, problem solving tasks, and creative challenges that directly foster students' ability to think divergently. Therefore, a student worksheet is highly needed as an effective medium to systematically enhance creative thinking skills, especially in elementary classrooms where students require both guidance and space for exploration. By integrating Student Worksheet into the learning process, teachers can create a more meaningful, interactive, and student centered environment that supports the development of creativity and learning independence.

Based on the problems, the creative thinking skills and learning motivation of students in the Diponegoro Cluster, Kembaran District, are still relatively low, as indicated by the average scores in the education quality report, which have not yet met the optimal standards. One contributing factor is the use of simple Student Worksheet that have not been able to accommodate the diversity of students' abilities. As a result, students tend to be less enthusiastic and do not work simultaneously when completing the given tasks. Unlike previous studies, the development of the Student Worksheet based on Discovery Inquiry and Fun Learning in this research is designed to be more engaging and adapted to the individual abilities of students to enhance their learning motivation and creative thinking skills. As

described previously, the researcher plans to design a valid and effective Student Worksheet to increase students' interest in learning independently, as well as contributing to improving students' creative thinking skills. Student Worksheet based on Discovery Inquiry and Fun Learning is an innovation in Mathematics learning, especially fraction material in grade 4. It is expected that, in addition to each student being actively and effectively involved in the learning process simultaneously and evenly and enthusiastically and easily absorbing the lessons delivered, the Student Worksheet based on Discovery Inquiry and Fun Learning can also encourage students' learning independence. Based on this, the researcher chose the title "Development of Student Worksheet based on Discovery Inquiry and Fun Learning to Improve Creative Thinking Skills and Independence of Elementary School Students.

Therefore, this research focuses on the development of a Student Worksheet based on Discovery Inquiry and Fun Learning to improve creative thinking skills and learning independence among elementary school students, providing a practical contribution to improving the quality of learning in line with the Merdeka Curriculum.

METHODS

This research is a Research and Development (R&D) study employing the Borg and Gall (Gall, Borg, & Gall, 2020), development model, which consists of ten systematic stages. The research was conducted during the odd semester of the 2024/2025 academic year, from August to December, in the Kembaran District, Banyumas Regency. The Borg and Gall development framework comprises several sequential stages, namely: research and data collection, planning, developing a preliminary form of the product, preliminary field testing, product revision, main field testing, operational product revision, operational field testing, final product revision, and dissemination and implementation. However, in this study, the results reported focus on the stages up to the final product revision, while dissemination and implementation are planned for subsequent research phases.

This study was limited to step eight because the subsequent stages require large-scale implementation, broader dissemination, and long-term evaluation, which were not feasible to conduct within the available timeframe and resource constraints. In addition, this limitation aligns with the objectives of the research, namely, to produce a valid and practical product through a

series of limited trials. Therefore, completing the process up to step eight was sufficient to achieve the goals of the study.

The research subjects consisted of two classes, namely the experimental class and the control class, each comprising 20 fourth grade students. Data collection techniques included both test and non-test methods. The test technique was used to assess students' creative thinking skills, while non test techniques such as interviews, documentation, and questionnaires were used to collect qualitative data. The instruments employed included interview sheets, media and material expert validation sheets, user response questionnaires (for teachers and students), learning independence questionnaires, and creative thinking skill tests.

To ensure the validity and reliability of the instruments, expert validation was conducted by two material experts, one media expert, and two education practitioners. The validity of the instruments was evaluated using content validity through expert judgment, while the reliability of the creative thinking and learning independence tests was determined using Cronbach's Alpha coefficient, indicating a high level of internal consistency.

Data analysis combined qualitative and quantitative approaches. Qualitative data from expert reviews, teacher and student responses, and open ended feedback were analyzed descriptively to improve the Student Worksheet based on the Discovery Inquiry and Fun Learning product. Quantitative data, obtained from test scores and questionnaire results, were analyzed statistically. The effectiveness of the Student Worksheet based on Discovery Inquiry and Fun Learning was tested using an independent samples t test, comparing the mean scores of the experimental and control classes to determine its impact on students' creative thinking and learning independence.

RESULTS AND DISCUSSION

Based on previous research by Noprinda and Soleh (2019), stated that Student Worksheets are a type of learning aid that can be used by teachers to increase student engagement or activity in the teaching and learning process. This is proven by previous research by Sianturi and Yusuf (2021) entitled "Development of Student Worksheets Based on Problem Based Learning to Improve Learning Outcomes in Business Economics Subjects." This includes research and development (R&D) with a 4 D design. The findings in this study

were the use of problem based Student Worksheets, and student responses were declared positive or good.

Referring to various previous research results that show that similar developments as above have successfully provided positive impacts and demonstrated good effectiveness, this strengthens confidence in the potential of this approach to be consistent and applicable in the educational context. Therefore, the researcher continued by researching the development of the Student Worksheet based on Discovery Inquiry and Fun Learning, which aims to improve the creative thinking skills and independence of elementary school students. This study used the Research and Development (R&D) method with the Borg and Gall development design, and produced a product that was proven to be feasible and effective in supporting the improvement of creative thinking skills and independence of elementary school students.

The results of the research and development conducted by this researcher produced a Student Worksheet based on Discovery Inquiry and Fun Learning, which is adjusted to the readiness of students to learn, from high ability, medium ability, and low ability. Based on previous research by Husna and Qurrata'aini (2023) differentiated learning is one way of learning to meet the needs of students because differentiated learning is a teaching and learning process in which students can learn material according to their abilities, what they like and what the needs of each student are so that they do not feel like failures or frustration in the learning process, thus increasing their abilities. In this study, the method used by Barg and Gall involved 10 stages, but the researcher only carried it out up to stage 8. his study was limited to step eight because the subsequent stages require large scale implementation, broader dissemination, and long term evaluation, which were not feasible to conduct within the available timeframe and resource constraints. In addition, this limitation aligns with the objectives of the research, namely, to produce a valid and practical product through a series of limited trials.

Therefore, completing the process up to step eight was sufficient to achieve the goals of the study. The steps that the researcher has taken include: (1) Identifying potential and problems; starting from a preliminary study on the quality report of elementary school education in the Diponegoro Cluster, Kembaran District, Banyumas Regency, (2) Collecting data; initial data needed for mapping student abilities is reviewed from the readiness to learn, namely high ability, medium ability, and low ability, the researcher conducted a mapping of the results of the odd semester 1 PSTS for mathematics subjects,

(3) Designing products; after conducting the mapping, a product is prepared that is adjusted to the needs of students, (4) Validating the design; validation of the Student Worksheet based on Discovery Inquiry and Fun Learning product involves expert material validators and expert media validators recommended by the supervising lecturer. The results of the validation of the Student Worksheet based on Discovery Inquiry and Fun Learning product were declared feasible by both validators with minor revisions, (5) Revising the design; at this stage the product was adjusted to several notes from the expert material validators and media experts, (6) Conducting a product trial; the product trial was conducted in classes other than the control class and the experimental class, (7) Conducting a product revision; after the product trial, then revising it if there were still deficiencies, (8) Conducting a usage trial; at this stage the researcher used the Student Worksheet based on Discovery Inquiry and Fun Learning product in the experimental class to obtain data on students' creative thinking skills and independence, while in the control class, Student Worksheet based on Discovery Inquiry and Fun Learning was not given. The following data were obtained in the study.

1. Teacher's Response

Based on the recapitulation of teacher response results, it is described that all indicators contained in the Student Worksheet based on Discovery Inquiry and Fun Learning after being used in the experimental class are considered good by achieving a perfect score of 100,00. In other words, the Student Worksheet based on Discovery Inquiry and Fun Learning is good for students to use easily, has good appeal for students to work on simultaneously, and can measure all indicator criteria with the following data details:

Table 1. Recapitulation of teacher responses

No	Aspect	Score Empirical	Score Hope	Presentation (%)
1	Didactic	35	35	100,00
2	Content	30	30	100,00
3	Language	15	15	100,00
4	Presentation	15	15	100,00
5	Time	5	5	100,00
Average				100,00

2. Student Response

Based on the results of the recapitulation of student responses, it is described that all indicators are considered good, but there is the most superior indicator, namely the language indicator with good criteria which has an average value of 94.50, meaning that in terms of language in Student Worksheet based on Discovery Inquiry and Fun Learning it is easy for students to understand, while the lowest indicator compared to the others is the evaluation indicator although it is still in the good category with an average value of 86.00, it can be interpreted that the evaluation questions in Student Worksheet based on Discovery Inquiry and Fun Learning are very challenging for students to think using all their abilities simultaneously so that they do not have time to ask their friends to find answers, but they independently complete the task well and look busy working on the questions given. With the following data details.

Table 2. Recapitulation of student response

No	Aspect	Score Empirical	Score Hope	Presentation (%)
1	Ease of Use	180	200	90,00
2	Attractiveness	269	300	89,67
3	Language	189	100	94,50
4	Evaluation	258	300	86,00
5	Time	89	100	89,00
Average				94

3. Results of the Effectiveness Test of Creative Thinking Skills

In general, it can be said that almost all students in the experimental class, after using the Student Worksheet based on Discovery Inquiry and Fun Learning, have good creative thinking skills evenly. However, the ones who are superior are students who have moderate abilities with an average score of 87,50 with the criteria "creative", while the lowest are students who have low abilities with an average score of 68,75 with the criteria "quite creative". With the following data details.

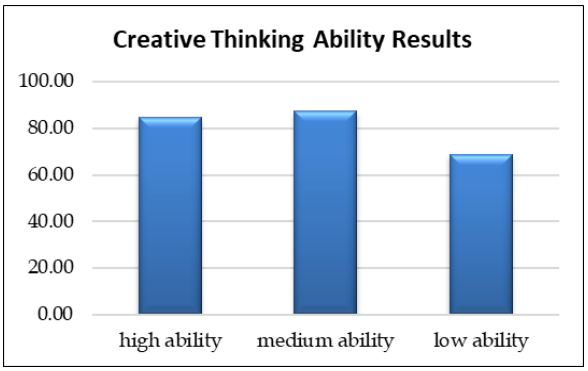

Figure 1. Diagram of Creative Thinking Ability Results

To test the effectiveness, normality test, homogeneity test, and hypothesis test are carried out. Hypothesis testing aims to test whether the developed Student Worksheet, based on Discovery Inquiry and Fun Learning, can improve creative thinking skills. The effectiveness test is carried out with the independent Sample t-test.

Table 3. Results of The Creative Thinking Ability Hypothesis Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Thinking Creatively	Equal variances assumed	1.11	.289	2.14	38	.038	7.90	3.68	.44	15.36
	Equal variances not assumed.			2.14	35.21	.039	7.90	3.68	.42	15.38

Based on table 3 above, the results of the t-test on students' creative thinking skills show a significant value (2-tailed) of 0.038 < 0.05, which indicates a difference. Therefore, Ho is rejected, and Ha is accepted. This shows that there is a significant difference between students' creative thinking skills in the control and experimental classes using the Student Worksheet based on Discovery Inquiry and Fun Learning.

4. Results of the Independence Effectiveness Test

Based on the results of the recapitulation of the independence of students in the experimental class, almost all of them are independent, but the most superior independence of students is owned by students with medium abilities with an average score of 93,64 with the "independent" criteria, while the lowest independence is among students with low abilities with an average score of 90,91 with the "independent" criteria. With detailed data as follows:

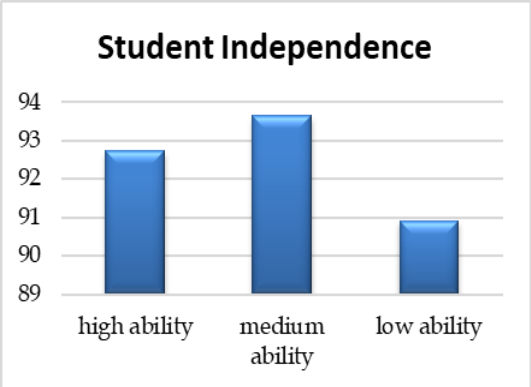

Figure 2. Diagram of The Results of Student Independence

To test the effectiveness, normality test, homogeneity test, and hypothesis test are carried out. Hypothesis testing aims to test whether the Student Worksheet, based on Discovery Inquiry and Fun Learning, can improve student independence. The effectiveness test is carried out using the independent sample t-test.

Table 4. Results of the independence hypothesis test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Independence	Equal variances assumed	3.48	.070	4.53	38	.000	12.100	2.67	6.70	17.50
	Equal variances not assumed			4.53	32.53	.000	12.100	2.67	6.70	17.53

Based on table 4 above, the results of the t-test on students' creative thinking skills show a significant value (2-tailed) of 0.000, < 0.05, which indicates a difference. Therefore, Ho is rejected, and Ha is accepted. This shows that there is a significant difference between student independence in the control and experimental classes using the Student Worksheet based on Discovery Inquiry and Fun Learning.

Thus, after conducting usability and effectiveness tests, it can be concluded that the Student Worksheet based on Discovery Inquiry and Fun Learning is feasible and effective in improving the creative thinking skills and independence of students with moderate ability, showing higher scores compared to students with high or low ability. This research aligns with previous studies conducted by Putra, Wiyanto, and Linuwih (2020), which showed that discovery-based learning can significantly enhance students' creative thinking skills and independence because students are actively involved in the process of discovering concepts, rather than merely receiving information. This finding indicates that questions at the moderate ability level still provide helpful clues for completion, while at the high ability level, such clues are not available. This suggests that the availability of clues is still needed, even for students with high ability. As stated by Kirschner, Sweller, and Clark (2006), discovery and inquiry learning, if conducted without adequate guidance, tend to be less effective, especially for students with high abilities due to excessive cognitive load.

Research on developing student worksheets has also been conducted by Syahfitri and Sulaiman (2023), with findings that Student Worksheets can significantly improve students' critical thinking skills and learning motivation. Budiman, Haryani, and Suminar (2024) in their research results showed that the development of inquiry-based worksheets is proven to be feasible and effective in enhancing elementary school students' critical thinking skills, with high validity scores and moderate n-gain score improvements. Furthermore, Sakina, Ekawati, and Dasna (2024) also stated that the use of inquiry based worksheets shows a significant positive effect in the context of science learning for elementary school students.

Based on these data findings, the researchers recommend that users of the Student Worksheet based on Discovery Inquiry and Fun Learning product correctly identify and categorize student abilities before implementing it. Furthermore, questions in the high ability category should still be provided

with clues to more effectively and maximally achieve the desired learning objectives.

CONCLUSION

Based on the research results, it can be concluded that the Student Worksheet based on Discovery Inquiry and Fun Learning is suitable for supporting Mathematics learning, particularly in developing creative thinking skills and independent learning in elementary school students. Furthermore, the Student Worksheet based on Discovery Inquiry and Fun Learning is effective in supporting Mathematics learning, particularly in developing creative thinking skills in elementary school students, particularly at high and medium ability levels. In addition, the Student Worksheet based on Discovery Inquiry and Fun Learning is effective in supporting Mathematics learning, particularly in developing independent learning in elementary school students, particularly in developing high and medium ability levels.

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