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Research Article

Development of Jumping Task-Based Student Worksheets to Improve the Critical Thinking Skills of Elementary School Students

Ari Rahayu[1] and Dedi Suwito[2]
1. SDN 01 Sangkaran Bhakti Lampung, Indonesia
2. SDN 5 Metro Timur Lampung, Indonesia

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ABSTRACT

This study aims to develop student worksheets based on *jumping tasks* to improve the critical thinking skills of elementary school students in science practicals on the subject of temperature and heat. The research subjects were 20 fifth-grade students at SDN 01 Sangkaran Bhakti in Way Kanan Regency, Lampung Province. The development stages used the ADDIE model, which has five steps: Analysis, Planning, Development, Implementation, and Evaluation. The field test used *a One Group Pretest-Posttest Design*, which is a form of *pre-experimental* research method. This design used one group. The types of data in the study were qualitative and quantitative. The effectiveness test obtained a *pretest* score of 55.38 in the low category and a *posttest* score of 80.00 in the high category. The conclusion of the research on the development *of jumping task-based worksheets* in elementary schools is that jumping task-based worksheets are practical and suitable for use in improving the critical thinking skills of fifth-grade elementary school students.

Corresponding Author:

Dedi Suwito
SDN 5 Metro Timur, Lampung, Indonesia
**e-mail:* *dedisuwito27@gmail.com*.

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INTRODUCTION

Education is one of the main factors in creating a generation with high insight and good character (Purmady, 2016) . Education is also an important part of developing human resources to improve the quality of life in the future. To develop quality human resources, quality education is needed. Education is so important that there needs to be an improvement in its quality. One of the efforts to achieve this goal is to always seek and find new breakthroughs or innovations in the learning process that have an impact on instilling national character and cultural values (Desyandri et al., 2019) . The quality of education is often used as a benchmark for the success of a country's development (Sirate & Ramadhana, 2017) . One way to obtain an education is through school as a formal education pathway with a structured and academic learning process.

The learning process in schools is structured based on the curriculum. The 2013 curriculum is an improvement on the previous curriculum, aiming to prepare the Indonesian generation to have the ability to live as individuals who are faithful, productive, creative, innovative, and affective, as well as contribute to society, nation, and state (Nizaar et al., 2021) . The implementation of the 2013 curriculum is carried out by training process skills reflected in learning activities (Kemendikbud, 2013) . The 2013 curriculum is a competency-based curriculum that includes attitude, knowledge, and skill competencies. To achieve the formulated competencies, thematic learning is chosen as the basis for learning (Fatonah & Yunianto, 2021) .

Thematic learning is a learning system that allows students, both individually and in groups, to actively explore and discover concepts and principles holistically, meaningfully, and authentically (Narti et al., 2016) .Thematic learning is a unity of themes that contain teaching ideas and integrate them into several topics (Apriliani & Radia, 2020) . Thematic learning is a learning concept that involves several subjects to provide meaningful experiences for students (Setiawan et al., 2019) . Thematic learning requires educators to be creative in selecting and developing learning themes (Fatonah & Yunianto, 2021) . Thematic learning in the 2013 curriculum expects educators to be able to teach or demonstrate how science develops in learning, such as by using innovative teaching materials.

The 2013 curriculum requires teachers to be more creative in improving the quality of learning and emphasizes higher-order thinking activities. This includes science learning, which has interesting material related to everyday life. Essentially, there are three components of science learning, namely products, processes, and scientific attitudes, to study events that occur in the surrounding environment (Pratiwi et al., 2020) .

Field evidence shows that educators rarely use teaching materials that are practical, innovative, varied, and appealing to students. The use of teaching materials in learning activities only focuses on theme books or package books, so that the cognitive assessment of students' science is still low and there is still a lack of skills among educators in developing teaching materials (Fatonah & Yunianto, 2021) . Based on observations in the field, it appears that students are less active in learning activities. Students' critical thinking skills are also low because they are not facilitated by teaching materials that are in line with critical thinking indicators. In addition, learning during the pandemic has encountered obstacles because the learning system uses two methods, namely online and offline.

Based on this, there is a need for creative and innovative teaching materials to support learning. These teaching materials are materials that can be used in both online and offline learning. In an education system that implements the concept of independent learning, it is very necessary to have learning materials that are specifically designed to be studied independently by students. Therefore, it is necessary to have professionals who are able to develop independent learning materials (Setiyadi & Gani, 2017) .

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Teaching materials are part of learning resources. Teaching materials play an important role in helping students achieve learning objectives. (Purmady, 2016) Teaching materials are a set of lesson materials that refer to the curriculum used in order to achieve competencies (Wati et al., 2021) . Teaching materials are an important aspect of successful learning. The use of supplementary teaching materials that have the potential to encourage students to be active in learning is one of them, namely the Student Worksheet (Pratiwi et al., 2020) . The use of SWL can be a link between educators and students to achieve learning objectives and train students' critical thinking skills.

Critical thinking skills are one of the important skills that students must master to overcome various problems encountered in daily life activities. *Low students' critical-thinking skills are a problem to be solved. Solution attempts are needed to improve these skills because critical-thinking skills have a strategic value in life. When critical-thinking skills are in place, students can think neutrally, objectively, reasonably or logically, become tough thinkers and reliable problem-solvers, and generate conclusions to do something.* (Rohmatulloh et al., 2021) .

According to Facione in Basri(2019) , critical thinking is the ability to absorb and filter existing phenomena. Several experts have different opinions regarding the components used to measure critical thinking skills. Facione in Basri(2019) states that there are six components of critical thinking skills, namely *Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-Regulation.* One of the reasons for the absence of critical thinking skills in students in learning activities is the use of teaching materials that do not stimulate the emergence of these critical thinking skills, one of which is student worksheets.

The student worksheets currently used in science learning activities are those included in the 2013 curriculum student textbooks. These worksheets contain instructions for practical steps to be carried out by students, along with short questions that do not require critical thinking to answer. As a result, students only provide short answers without accompanying arguments related to the results of the practical work.

Student worksheets are a means of assisting and facilitating teaching and learning activities, thereby creating effective interaction between students and educators and increasing student activity in improving learning achievement. Muslem said that student worksheets are a learning resource that can be developed by educators as facilitators in learning activities (Muslem et al., 2019) . Student worksheets can be designed and developed according to the conditions and situations of the learning activities that will be encountered. Student worksheets are sheets containing tasks that must be completed by students (Katriani, 2016) . Activity sheets usually consist of instructions and steps to complete a task. The advantage of using student worksheets is that it makes it easier for educators to carry out learning, while students will learn independently and learn to understand and carry out written tasks.

In addition to being attractive, practical, and innovative, the content of student worksheets must also be considered. One effort that can be made is to develop *Jumping Task-based* student worksheets (Nofrion, 2017) . *Jumping tasks* are learning activities that present problems with a higher level of difficulty to improve students' abilities from their actual abilities to their potential abilities (Samad et al., 2017) . *Jumping Tasks* challenge students to think critically so that they do not get bored in learning. In addition, through *Jumping Tasks*, students are trained to think independently (Pratiwi et al., 2020) . *Jumping Tasks* are challenging questions/tasks that are above the curriculum level (Nofrion, 2017).

In this study, the researcher chose to implement the student worksheets developed in the science practicum on the subject of temperature and heat. The reason for this is that the subject of temperature and heat is very close to the daily lives of students, but the phenomenon is quite difficult for students to explain scientifically. The subject of temperature and heat is rich in concepts that are interrelated. For example, in explaining heat as energy that transfers from one object to another as a result of temperature differences, there are two concepts, namely energy and temperature. It is easier for

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students to understand these concepts comprehensively, so they need to do practical activities themselves. The material on temperature and heat is included in the science lesson for fifth graders in elementary/Islamic elementary schools.

RESEARCH METHOD

This research method is development research. Sugiyonno(2016) states that research and development have the function of developing and validating products. This research develops a product in the form of *Jumping Task*-based student worksheets to improve the critical thinking of fifth-grade elementary school students. This product is teaching material for students, with content focused on basic Natural Science competencies, namely "Temperature and Heat." The population in this study were educators and students of SDN 01 Sangkaran Bhakti. The sampling technique used was *purposive sampling,* with a sample size of 20 fifth-grade students of SDN 01 Sangkaran Bhakti and 1 fifth-grade educator.

ADDIE model development research. Based on (Amelia & Abdurrohman, 2021) The steps that can be implemented in the development of this media consist of 5 stages, including (1) *Analysis*, (2) *Design*, (3) *Development*, (4) *Implementation,* (5) *Evaluation* (Amelia & Abdurrohman, 2021) . The elaboration in this study is as follows:

1. *Analysis* is the initial stage carried out by researchers to analyze problems and needs, thereby determining whether or not it is necessary to develop *Jumping Task*-based student worksheets. (Apriliani & Radia, 2020) . In addition, the researchers reviewed theories or studies related to the concept of student worksheets, analyzed the basic competencies and learning indicators to be achieved to improve critical thinking. *Analysis* is the initial stage conducted by researchers to analyze problems and needs, thereby determining whether or not it is necessary to develop *Jumping Task-based* student worksheets. (Apriliani & Radia, 2020) . In addition, researchers reviewed theories or studies related to student worksheets concepts, analyzing basic competencies (KD) and learning indicators to be achieved in order to improve critical thinking.
2. Planning *(Design),* in this stage, researchers develop a draft product, the result of which is a prototype of *Jumping Task-based* student worksheets.
3. *Development*: This stage involves several steps, including planning *Jumping Task-based* student worksheets. Researchers must design these in detail to avoid misunderstandings when delivering the material. The development *of Jumping Task-based* student worksheets is also tailored to the characteristics of the students. At this stage, validation activities are also carried out by language, material, and media experts to determine whether the resulting product is suitable and feasible for use.
4. *Implementation:* After refining the product, researchers must retest the developed product to determine its level of success and suitability. Practicality tests were conducted on 20 fifth-grade students at SDN 01 Sangkaran Bhakti in the 2021-2022 academic year. Next, the effectiveness of *the Jumping Task*-based student worksheets was tested to observe the critical thinking of the students. At this stage, empirical product testing was carried out using *a One Group Pretest-Postest Design,* which is a form of *Pre-Experimental* research method. This design uses one group.
5. *Evaluation,* refinement of the field test product, to improve the product's shortcomings so that it is perfected after being developed and adjusted to the actual conditions in the field based on product testing.

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The types of data in this study are qualitative and quantitative. Qualitative data is obtained from observations, critiques, and suggestions obtained through questionnaires. Meanwhile, quantitative data is obtained from product validation questionnaire scores, student responses, learning process observation sheets, and learning outcome scores. The critical thinking indicators used according to Facione (Basri et al., 2019) are Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-regulation. The field trial subjects consisted of 20 fifth-grade students at SDN 01 Sangkaran Bhakti in Way Kanan Regency, Lampung Province.

$$V = \frac{\sum_{i=1}^{n} s_n}{n(c-1)}$$

To interpret the validity assessment data, the criteria for analyzing the average scores used in Table 1 below are as follows:

Table 1. Validity Criteria for the Product

Scale Range	Category
$V > 0.84$	Highly valid
$V > 0.68 – 0.84$	Valid
$V > 0.52 – 0.68$	Fairly valid
$V > 0.36 – 0.52$	Less valid
$V \leq 0.36$	Not valid

Meanwhile, to read the data on the assessment results of educators and students, use the categories shown in Table 2 below:

Table 2. Practicality Categories for Educators and Students

Average Score	Score Range	Category
$\bar{X} > 4.2$	$\bar{X} > 84$	Very practical
$\bar{X} > 3.4 – 4.2$	$\bar{X} > 68$ - 84	Practical
$\bar{X} > 2.6 – 3.4$	$\bar{X} > 52$ - 68	Fairly practical
$\bar{X} > 1.8–2.6$	$\bar{X} > 36$ - 52	Less practical
$\bar{X} \leq 1.8$	$\bar{X} \leq 36$	Not practical

The effectiveness of *Jumping Task*-based student worksheets can be analyzed by giving *pretest and posttest* questions to students. The resulting assessment scores become a measuring tool in the use of student worksheets IPA to determine the progress of students' critical thinking skills. The formula used for analysis is as follows .

$$g = \frac{(\%\ rata-rata\ posttest) - (\%rata-rata\ pretest)}{100-\%rata-rata\ pretes}$$

The N-gain score category can be determined based on the N-gain value in the form of a percentage. The division of the N-gain score category (Nizaar et al., 2021) can be seen in Table 3 below**:**

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Table 3. N-gain Criteria

Gain Improvement Criteria	Normalized Score
g-High	$g \geq 0.7$
g-Medium	$0.7 > g \geq 0.3$
Low g	$g < 0.3$

RESULTS AND DISCUSSION

The learning process still involves educators as active subjects in explaining the material, so that learning is more *teacher-centered*. Students are accustomed to questions with a low level of difficulty. So when students are given different questions with a higher level of difficulty, they experience difficulties. Likewise, when problems are given to students, they still do not understand the problems. Students' mistakes in answering critical thinking questions include misunderstanding the question, errors in transformation, and errors in accuracy due to haste, which lead to misinterpretation of the meaning of the question, meaning that students do not yet have a good understanding of the material. Therefore, *jumping task-based* student worksheets development was implemented to improve students' critical thinking process. This development uses the ADDIE model, which has 5 steps (Amelia & Abdurrohman, 2021) .

The initial stage was analysis, which involved analyzing the problems and needs to determine whether or not it was necessary to develop *Jumping Task*-based student worksheets. (Apriliani & Radia, 2020) . In addition, the researchers reviewed theories or studies related to the concept of student worksheets and analyzed the basic competencies and learning indicators to be achieved in order to improve critical thinking. In the planning stage, the researchers developed a draft product, the result of which was a prototype of *Jumping Task-based* student worksheets. In the development stage, the researchers had to design the product in detail to avoid misunderstandings when delivering the material. The development *of Jumping Task-based* student worksheets was also tailored to the characteristics of the students. At this stage, validation activities are also carried out by language, material, and media experts to determine whether the product is suitable and feasible for use.

In the implementation stage, the researcher re-tests the developed product to determine its level of success and suitability. The practicality test was conducted on 20 fifth-grade students at SDN 01 Sangkaran Bhakti in the 2021-2022 academic year. Next, the effectiveness of *the Jumping Task-based* student worksheets was tested to observe the students' critical thinking. At this stage, empirical product testing was carried out using *a One Group Pretest-Posttest Design*, which is a form of *Pre-Experimental* research method. This design uses one group. The evaluation stage involved refining the products tested in the field to improve any shortcomings so that they could be perfected after being developed and adjusted to the actual conditions in the field based on product testing.

Figure 1. Display of Jumping Task-based student worksheets

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The student worksheets display is a revised student worksheets. The student worksheets is teaching material developed to observe the improvement in students' critical thinking after learning using the student worksheets. The student worksheets consists of only two sheets based on *Jumping Task*.

After revision, the next step was to test its implementation in the field. The practicality test was conducted on 20 fifth-grade students at SDN 01 Sangkaran Bhakti in the 2021-2022 academic year. Next, the effectiveness of *the Jumping Task-based* student worksheets was tested to observe the critical thinking of students. At this stage, empirical product testing was carried out using *a One Group Pretest-Posttest Design*, which is a form of *Pre-Experimental* research method. This design uses one group. Next, the field-tested product was refined to improve its shortcomings so that it could be perfected after being developed and adjusted to the actual conditions in the field based on product testing.

The types of data in this study were qualitative and quantitative. Qualitative data were obtained from observations, critiques, and suggestions obtained through questionnaires. Quantitative data were obtained from product validation questionnaire scores, student responses, learning process observation sheets, and learning outcome scores. The critical thinking indicators used according to Facione (Basri et al., 2019) are Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-regulation. The field trial subjects consisted of 20 fifth-grade students at SDN 01 Sangkaran Bhakti in Central Lampung.

The field trial subjects consisted of 20 fifth-grade students at State Elementary School 1 Meranggi Jaya, Central Lampung. The data analysis of the expert validation results, which included media experts, language experts, and subject matter experts, as well as the assessment instrument and question validation sheets, was conducted using the following Aiken index formula. The results of the validation conducted are as follows:

Table 4 Assessment Results of student worksheets

No	Assessment Aspect	Validation	Category
1	Language suitability	0.838	Valid
2	Content/material feasibility	0.733	Valid
3	Appearance/media suitability	0.833	Valid
4	Cognitive instruments	0.666	Sufficiently valid
5	Affective instrument	0.732	Valid
6	Psychomotor instruments	0.645	Sufficiently Valid
7	Question instruments	0.833	Valid
	Total average	**0.741**	**Valid**

The calculation results of the table above obtained a language validation score of 0.83, which is categorized as valid. Content/material validation with a score of 0.73 is categorized as valid. Display/media validation with a score of 0.83 is categorized as valid. Cognitive assessment validation obtained a score of 0.66 and is categorized as sufficiently valid. Affective assessment validation obtained a score of 0.73 and is categorized as valid, while psychomotor assessment validation obtained a score of 0.64 and is categorized as sufficiently valid. Item validation obtained a score of 0.83, categorized as valid. This means that from the validation conducted by experts regarding the language, content, and media of the student worksheets, the assessment instrument and item instrument obtained an average total score of 0.741, categorized as valid and can be used to improve students' critical thinking.

Table 5. Results of the Validation of the Educator Practicality Instrument (N=3)

No	Assessment Aspect	Average	Percentage	Category

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1	Ease of use	4.44	89	Very practical
2	Time efficiency	4.16	83	Practical
3	Attractiveness	4.88	98	Very practical
4	Benefits	4.33	87	Very practical
	Holistic Average	**4.45**	**89**	**Very practical**

Based on the table above, from the results of the practicality test, educators can determine the assessment per aspect with a holistic average of 4.45 and a percentage of 89%, which is categorized as very practical.

Table 6. Results of the Practicality Instrument Validation for Students (N=20)

No	Aspect	Average	Percentage	Category
1.	Ease of use	4.27	85	Very Practical
2.	Time required	4.31	86	Very Practical
3.	Easy to interpret	4.32	86	Very Practical
	Holistic Average	**4.30**	**86**	**Very Practical**

Based on the table above, from the results of the practicality test, it can be seen that the assessment per aspect with a holistic average of 4.30 and a percentage of 86% is categorized as very practical.

1. Cognitive Assessment Results

The cognitive assessment results yielded the following final scores:

$$\text{Final Score} = \frac{2080}{2600} x\ 100\% = 80\ (\text{Tinggi})$$

The final cognitive assessment score is 80, categorized as high.

2. Affective Assessment Results

The affective assessment results obtained the following final scores:

$$\text{Final Score} = \frac{359}{400} x\ 100\% = 89(\text{Sangat Tinggi})$$

The final result of the affective assessment scored 89.75, which is in the very high category.

3. Psychomotor Assessment Results

The psychomotor assessment results obtained the following final score:

$$\text{Final Score} = \frac{269}{320} x\ 100\% = 84(\text{Tinggi})$$

The final result of the psychomotor assessment scored 84.06, which is in the high category.

4. *Pre-test* and *Post-test* Results

The effectiveness of *Jumping Task*-based student worksheets can be analyzed by giving *pretest and posttest* questions to students. The resulting assessment scores become a measuring tool in the use of student worksheets IPA to determine the progress of students' critical thinking skills. The

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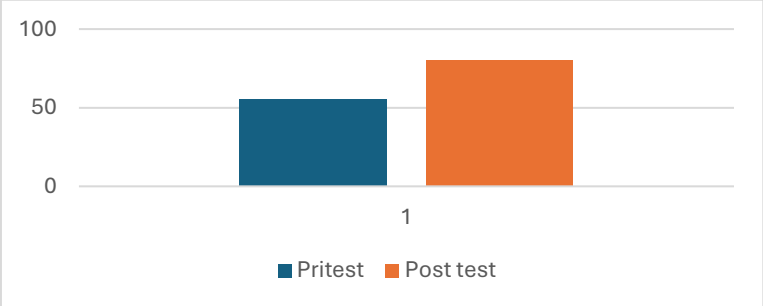
formula used is to find the n-gain value. The category of n-gain score can be determined based on the n-gain value in percentage form.

$$\text{Final } \textit{Pretest} \text{ Score} = \frac{1440}{2600} x\ 100\% = 55{,}38 \text{ (Rendah)}$$

$$\textit{Final Posttest} \text{ Score} = \frac{2080}{2600} x\ 100\% = 80{,}00 \text{(Tinggi)}$$



Graph 2. Comparison of *Pretest* and *Posttest* Results

N-gain score acquisition:

$$g - \frac{(\%\ rata-rata\ posttest) - (\%rata-rata\ pretest)}{100-\%rata-rata\ pretes}$$

$$g - \frac{}{100-55{,}38}$$

g = 0.552

Based on the N-gain improvement category, the normalized score is $0.7 > g \geq 0.3$, so g=0.552 falls into the moderate category.

Based on the effectiveness test results, the comparison values between the *pretest* and *posttest* scores were 55.38 for *the pretest*, which is in the low category, and 80.00 for the *posttest*, which is in the high category. The n-gain value of 0.552 falls into the moderate category. Therefore, the research on the development of student worksheets based on *jumping tasks* to improve the critical thinking skills of elementary school students resulted in a moderate category, meaning that the development of student worksheets based on *jumping tasks* can improve students' critical thinking.

CONCLUSION

In order to hone students' critical thinking skills, educators need learning tools that can help facilitate students to grow and develop their critical thinking abilities. Through worksheets based on one of the methods that has been proven to improve critical thinking skills, namely *Jumping Task*, it is hoped that students can develop their critical thinking skills. In addition, students also need student worksheets that can motivate them to learn, in terms of the form and content of *Jumping Task*-based student worksheets. Several students also stated that the presentation of problems related to the real world made them enthusiastic about learning, because the lessons were not only focused on memorizing material.

The results of the research on the development *of Jumping Task-based* student worksheets on the subject of temperature and heat concluded that the results of the development process of the learning tool in the form of *Jumping Task-based* student worksheets, through the results of the language validation sheet from 2 expert validators of learning tools, showed a percentage of 87% in

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the very practical category. the results of the material instrument validation from 2 validators obtained a percentage of 80% in the practical category, and the results of the learning media expert validation sheet through 2 validators obtained a result of 85% in the very practical category.

Based on the *pre-test* results, the average score of the students was 55.38, which is categorized as low, and the *post-test* results showed that the average score of the students was 80.00, which is categorized as high. Thus, it can be concluded that *the Jumping Task*-based student worksheets can improve the critical thinking skills of fifth-grade students at SDN 01 Sangkaran Bhakti.

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