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Development of Scrapbook Media to Improve Critical Thinking Skills of Junior High School Students in Science Learning

Winda Raina Sari, Supeno*, & Ulin Nuha

Department of Science Education, Universitas Jember, Indonesia

Abstract: Critical thinking is a high-level skill that is very urgent for students. Nevertheless, the critical thinking skills of junior high school students in science learning still need to be improved. This research was conducted to produce an educational product, namely, scrapbook media in science learning to enhance the critical thinking skills of junior high school students. Researchers used the Plomp development model to collect data, including preliminary research, prototyping stage, and assessment phase. The validation results from the experts reached 86%, with very valid criteria in all four aspects. In the practicality test results from the learning implementation observation sheet, 98% of the results were obtained with convenient criteria. The result of the N-gain analysis with high criteria. Based on these results, it can be concluded that the scrapbook media in science learning to improve the critical thinking skills of junior high school students is valid, practical, and effective. Furthermore, scrapbook media can be used to facilitate students in science learning. Scrapbook media can be designed by integrating learning activities that require active students so that their critical thinking skills can develop. Students can learn to interpret, analyze, evaluate, explain, and make inferences about various scientific phenomena using scrapbook media so that their critical thinking skills develop. Science teachers can use scrapbook media and create it for quality science learning.

Keywords: scrapbook media; critical thinking; science learning.

Abstrak: *Berpikir kritis merupakan keterampilan berpikir tingkat tinggi yang diperlukan siswa. Walaupun demikian, keterampilan berpikir kritis siswa sekolah menengah dalam pembelajaran IPA masih perlu terus dikembangkan. Tujuan penelitian ini adalah mengembangkan media scrapbook dalam pembelajaran IPA untuk meningkatkan keterampilan berpikir kritis siswa SMP yang valid, praktis dan efektif. Produk penelitian dikembangkan menggunakan model pengembangan Plomp dengan langkah-langkahnya meliputi preliminary research, prototyping stage, dan assesment phase. Hasil validasi ahli terhadap produk media mencapai 86% dengan kriteria sangat valid pada empat aspek penilaian. Pada hasil uji coba diperoleh data kepraktisan yang menggambarkan keterlaksanaan pembelajaran sebesar 98% dengan kriteria sangat praktis. Implementasi produk dalam pembelajaran IPA menghasilkan N-gain skor dengan kriteria tinggi. Berdasarkan hasil tersebut, dapat disimpulkan bahwa media scrapbook dalam pembelajaran IPA untuk meningkatkan kemampuan berpikir kritis siswa SMP dinyatakan valid, praktis dan efektif. Media pembelajaran yang dikembangkan dapat digunakan dalam pembelajaran IPA. Dalam implementasinya di kelas, media scrapbook dapat didesain dengan mengintegrasikan aktivitas yang menuntut siswa aktif sehingga dapat mengembangkan keterampilan berpikir kritis. Siswa dapat belajar menginterpretasi, menganalisis, mengevaluasi, mengeksplanasi, dan menginferensi berbagai fenomena sains menggunakan media scrapbook sehingga keterampilan berpikir kritisnya berkembang. Guru dapat menggunakan media scrapbook dan mengkreasinya secara inovatif untuk meningkatkan kualitas pembelajaran IPA.*

Kata kunci: *media scrapbook; berpikir kritis; pembelajaran IPA.*

Supeno

*Email: supeno.fkip@unej.ac.id

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▪ INTRODUCTION

Science learning is constructing knowledge about natural phenomena that emphasizes one symptom with another. Students must carry out scientific activities involving thoughts, reasoning, behavior, procedures, products, and applications that are carried out thoroughly (Özgelen, 2012; Pulungan & Nasution, 2021; Suryawati & Osman, 2017). The scientific learning process does not focus on one part involving various aspects. Likewise, in science learning, critical thinking is one of the thinking skills that students must have in learning science (Duran & Dökme, 2016; Meryastiti et al., 2022; Tiruneh et al., 2018; Vieira & Tenreiro-Vieira, 2016). Learning science that integrates necessary thinking skills will involve students in physical and mental learning activities. Students learn to understand, analyze, synthesize, and evaluate facts that have been obtained or that they have collected from experiences, observations, and descriptions of what they do, including analysis or communication (Alsaleh, 2020; Nasihah et al., 2020; Wahono et al., 2022; Wechsler et al., 2018). With the necessary thinking skills, students can solve their problems and do so with independent consideration.

Critical thinking skills are essential for students and graduates to face a universal and competitive era (Cevik & Senturk, 2019; Dwyer et al., 2014). Critical thinking is a significant part of the implementation of learning today. Critical thinking requires students to evaluate the truth, conjecture, logic, and language underlying a question (Asih & Mursiti, 2018; Bensley et al., 2010). Educators must forge students to develop intellectual, emotional, and skill aspects. Based on a review of constructivist theory, students must construct knowledge and critical thinking skills in the learning process (Indayani et al., 2021; Al Mamun et al., 2020; Sasson et al., 2018). This condition requires teachers to cultivate thinking skills during the learning process and train them in students because critical thinking skills are advantageous and needed by students in everyday life.

Although critical thinking skills are essential for students, developing them in science learning is still a challenge for teachers, so students still have difficulty developing their necessary thinking skills. Several problems commonly occur in critical thinking skills, especially reasoning (Mustika et al., 2019; Paulsen & Kolstø, 2022). Several factors are the cause of why science learning is still often carried out conventionally or teacher-centered learning. Nuraisah et al. (2016) stated that student-centered learning could not significantly improve critical thinking skills. The results of the research by Nuryanti et al. (2018) revealed that the cause of students' weak essential thinking skills arises from the lack of implementation of active learning that maximizes students' thinking potential. The lack of student activity in education causes low thinking skills and can impact the following learning process. Therefore, the development of critical thinking skills in students needs to be applied by teachers to students.

The low ability of students' critical thinking can also be due to limited innovation in the learning media used in the teaching and learning process. The application of learning media can affect the process and learning outcomes and improve the quality of education. Jamaludin et al. (2020) state that learning activities do not use much instructional media, even though the media plays a vital role in teaching and learning activities in improving students' critical thinking skills. Teachers tend to dominate the

class and do not use innovative instructional media, so they experience difficulties in get learning objectives. Therefore, the learning process should be done using imaginative and creative learning media (Febrianti et al., 2021; Heflin et al., 2017; Supeno et al., 2018; Yuliani et al., 2022) so that students are serious and enjoy participating in learning.

One innovative media that has not been developed in science learning is scrapbook media. Scrapbook media has several advantages for learning (Veronica et al., 2018). Media scrapbook has an attractive appearance because, in their preparation, pictures and important notes are decorated. Scrapbook media can be created by combining photographs, notes, and decorations (Wusqo et al., 2021). Scrapbook media is also realistic because it can be packaged by presenting the subject matter combined with images to look more natural. In dealing with the independence of time and space, scrapbook media can give rise to problem-solving regarding the many events or natural phenomena that are difficult to present directly and repeat.

One of the innovative efforts that can be made to develop thinking skills is to utilize scrapbook media in learning. The results show a significant link between the application of scrapbook media to students' critical thinking abilities (Hakim, 2021). Using instructional media in learning can also support teachers in achieving learning goals. According to Putri (2014), scrapbook learning media is the art of decorating or designing images. Scrapbook learning media can be designed as a book with lots of patches. Instructional media of scrapbooks is often used as clippings or notes important to readers (Wardhani, 2018). Students can develop critical thinking skills by exploring, analyzing, and evaluating various information provided in the media. With these multiple features, scrapbook media has the potential to be developed and applied in science learning to improve critical thinking skills.

This research was conducted to develop a product in the form of learning media in the form of a scrapbook to improve junior high school students' critical thinking skills in learning natural sciences. The development of scrapbook media can be used as a solution to problems in enhancing students' necessary thinking skills. Implementing science learning using scrapbook media is expected to increase students' interest and learning activities to develop critical thinking skills. The essential features provided by the scrapbook are expected to encourage students to learn actively. Students can do physical and mental exercises to develop their thinking skills. For this reason, scrapbook media must be developed in stages following development research to obtain a viable product. Based on the description of the background above, the main problems in this study are:

1. What is the validity of the scrapbook learning media developed to improve thinking skills in science learning?
2. How practical is the scrapbook learning media developed to improve thinking skills in learning science?
3. What is the scrapbook learning media effectiveness in improving thinking skills in science learning?

▪ METHOD

Participant

The research was conducted at SMPN 3 Bandowoso. The participants in this

study were 30 students of class VII-G. Students in the science learning classroom consist of twenty females and ten males. The selection of the trial class was determined based on information from the science teacher at SMP Negeri 3 Bondowoso, who stated that students' critical thinking skills from all courses in class VIII still needed to be developed and trained. Science learning so far has never used innovative media such as scrapbooks.

Research Design and Procedures

This research is development research conducted to design products of scrapbook media. The stages of development are carried out regarding the steps of the Plomp development model. The Plomp development model is chosen because it is seen as more flexible; each activity can be adapted to the characteristics of the research. Ummah et al. (2019) stated that quality learning needs innovative media with suitable criteria, and its purity meets the pretty good category. The Plomp development model has three phases: preliminary research, prototyping, and assessment (Plomp, 2013).

Activities carried out at the preliminary research stage are literature studies that aim to get an initial description of learning at the SMP Negeri 3 Bondowoso research site. At this stage, information is collected regarding the learning process, and a needs analysis is carried out to see the school curriculum implemented to fulfill the competencies that students must master. The information collected can be obtained through an interview process. The information obtained from the interviews was then used to develop science learning scrapbook media on additives and addictive substances to improve critical thinking skills.

The activity carried out at the prototyping stage was designing scrapbook media using the canva.com editing website. The selected science learning materials are about additives and addictive substances. Researchers also developed learning tools in syllabi, lesson plans, and the required assessment instruments in the form of expert validation sheets, learning implementation sheets, and pre-test and post-test questions. In this stage, the development process produces a draft I media scrapbook. The next step is the validation process, in which three expert validators evaluate draft I products. After the draft I of the scrapbook media is declared valid, the product is feasible and ready to be used in the learning process in class. If the scrapbook media is declared invalid, it needs to be revised. Scrapbook media that has passed the revision stage is re-validated by the validator to get draft II and is ready to be tested in classroom learning.

The research activities in the assessment phase are implementing science learning in class using scrapbook learning media. Three observers observed the learning process to obtain data on the implementation of the teaching so that it could be assessed whether the scrapbook media could be declared practical. In this phase, an analysis of the effectiveness of the scrapbook media was also carried out, where students were given questions in the form of a pre-test and post-test to measure critical thinking skills. The test was developed regarding indicators of essential thinking ability according to Facione (2011), which consists of six aspects: interpretation, analysis, evaluation, inference, explanation, and self-regulation. If the product has been declared valid, practical, and effective, it can be interpreted that the product development has reached the final stage.

Instruments

Data collection techniques using observation and tests. The instruments used were scrapbook media validation sheets, learning implementation observation sheets, and test sheets. The validation sheet contains questions about the feasibility of scrapbook products based on content and construction aspects (Nieveen, 1999). The implementation observation sheet contains an assessment guide for learning activities carried out using the product scrapbook. The essay test of ten items is based on indicators of critical thinking skills in the material of additives and addictive substances.

Data Analysis

Three experts in learning media carried out scrapbook media validation. The value obtained from the expert validator is analyzed using the following calculation. Three observers assessed the level of practicality of the scrapbook media. Criteria for implementing learning are determined based on predetermined conditions (Suharsimi, 2006). According to the test result, the effectiveness level of scrapbook media is calculated using the n-gain formula based on the scores of the pre-test and post-test results of critical thinking skills (Hake, 1998). In addition to the N-Gain test, to determine the effectiveness of the scrapbook media, a statistical test was also used using a t-test. The t-tests were carried out using paired sample statistics on the pre-test and post-test data. The aim is to determine whether there is an average difference between the two paired samples, namely the average value of critical thinking skills during the pre-test and the post-test. Before carrying out the differential test, a normality test was carried out to determine whether the data distribution was normally distributed.

▪ RESULT AND DISSCUSSION

The scrapbook media was developed on the science subject matter of additives and addictive substances. The primary competency on this topic is to explain various additives in food and beverages, addictive substances, and their impact on health. Learning media features are used to achieve basic competency, especially critical thinking skills. Product development stages include preliminary research, prototyping stage, and assessment phase (Plomp, 2013). The process and results of each research step can be explained as follows.

Scrapbook Media Validation

The final product of this development research is scrapbook media to improve the critical thinking skills of junior high school students. Media scrapbook contains science learning materials with essential features of thinking (Facione, 2011). The display of the scrapbook media that has been downloaded from the canva.com website is shown in Figure 1. When used, students can scroll up or down according to the material being studied.

Figure 1. Scrapbook media view

The next stage is the product validation process by three learning media expert validators to determine the feasibility of the media. The data analysis used a validation sheet to assess the validity of the product filled out by an expert validator. The aspects evaluated in the validation process are content validation and construct validation. Content validity related to parts of need and state of the art of scrapbook media. The needs aspect states that critical thinking skills are essential skills needed by students today. The novelty aspect says that the scrapbook media has necessary features for students to develop their thinking skills. The construct validity is related to the advisability of the scrapbook on language, presentation, and graphical aspects.

Based on the results of the validity analysis of the scrapbook media from the three expert validators, it shows an average percentage of 86% with a correct category in all four aspects of the assessment. Each aspect of the evaluation also achieved very valid criteria, with a portion of the content validation aspect at 90%, the language aspect at 82%, the presentation aspect at 90%, and the graphical aspect at 83%. This condition states that the scrapbook media in science learning about additives and addictive substances is suitable for science learning. Based on the validation results, the results show that the scrapbook media is included in the outstanding category.

The validation results show that the scrapbook media has the correct content and material for each activity with adjusted learning subskills of critical thinking. The media scrapbook has been arranged sequentially and grouped logically. In addition, the media scrapbook also has compatibility questions with the order of material and concepts from critical thinking skills. Conceptually, scrapbook media can play a role in encouraging students to learn to develop critical thinking. Regarding subject matter content, scrapbook media follows the concepts and subject matter of additives and addictive substances. Regarding appearance, the scrapbook media matches the pictures and illustrations with the science material and tasks on each page. Paramita et al. (2018)

state that a product is valid in content and material if the material concept with achievement indicators is appropriate, clear, and coherent.

Construct validity consists of assessments on language, presentation, and graphics. The fact of scrapbook media on language aspects is included in the excellent category. A media scrapbook has been prepared by considering the grammatical correctness used. Media scrapbook also has sentence regularity with the level of thinking skills and subject matter abilities. The sentences used do not contain double meanings. In addition, the scrapbook media has clear instructions and directions and has the suitability of writing in symbols. The language aspect is the central aspect of a product because using explicit language can make it easier for students to understand the subject matter (Ridho et al., 2020). Good language shows harmony between sentence structure and the terms in the learning media (Sriwahyuni et al., 2019). It can be said that students will quickly understand the language used in the scrapbook media.

The aspect of the presentation of scrapbook media is included in the outstanding category. It means that the scrapbook media has coherence in product presentation and has an appeal so that students are interested in learning. The arrangement of the layout of the scrapbook media is perfect and neat so that it is easily accessible to students. Type and size fonts are chosen according to the characteristics of the students and the science content. Asyhari & Silvia (2016) state that good media must consider the ease of learning the material, the systematic accuracy of the presentation of the material, the clarity of sentences, the clarity of symbols and symbols, the clarity of terms, and the suitability between real examples and subject matter.

The graphical aspect of scrapbook media is included in the outstanding category. It means that the scrapbook media has text that is easy to read. Media has an exciting color combination. In addition, the letters used in the scrapbook media are attractive and easy for students to read. The images displayed are stunning, with clear image resolution. A good display can make it easier for students to access the media so that the process of learning science learning content takes place smoothly.

The Practicality and Effectiveness of Scrapbook Media

After the product has passed the prototype validation stage, the next stage is the assessment phase. At this stage, the scrapbook media field trial was carried out. When implemented in science learning, the effectiveness and practicality of the product are measured. Scrapbook media products were tested in the learning process during three teaching meetings. The results of the analysis of observational data on the science learning process using the scrapbook are shown that each phase of learning can take place correctly. Based on the practicality analysis of the observation sheet of learning applicability, it offers an average percentage of 98% in the convenient category. This result indicates that scrapbook media is suitable to use in the learning process. All science learning activities can be carried out properly according to what has been prepared in the lesson plan. However, several obstacles, along with suggestions from the three observers, can be used to improve the learning process further.

Observing the implementation of learning shows that science learning using scrapbook media is active. Students carry out a series of scientific processes to construct scientific knowledge. Students actively participate in the learning process when implementing the teaching and learning process using scrapbook media. Students have

no difficulty accessing scrapbook media because the media access process only presses the document link shared on the WhatsApp group. Students can scroll up or down according to the material being discussed. The use of scrapbook media in science learning was carried out during three meetings. Students develop critical thinking skills following the stages of activities in the media. The locations of learning carried out by students lead to the achievement of critical thinking sub-skills. Scrapbook media can be used in the classroom science teaching and learning process. Products are said to be practical if the media developed is easy and can be implemented in learning (Nieveen, 1999).

The effectiveness of scrapbook media is based on the value of critical thinking skills obtained by students during the pre-test and post-test. The results of gain scores for each aspect of critical thinking skills are shown in a bar chart in Figure 2. Based on these data, when compared with the gain criteria (Hake, 1998), it can be explained that critical thinking skills increase in the high category, except for the aspect of analysis, which grew in the middle class. This show that using scrapbook media in science learning can develop abilities in interpreting, evaluating, inferring, explaining, and self-regulation. Learning features contained in scrapbook media can facilitate learning activities, both physically and mentally, so that critical thinking skills develop correctly. Even so, the aspect of analysis only increased in the moderate category. Students are still unable to analyze the scientific phenomena in the scrapbook. To overcome this, the effort that can be made next is to provide additional features so that students can learn to analyze scientific phenomena more easily.

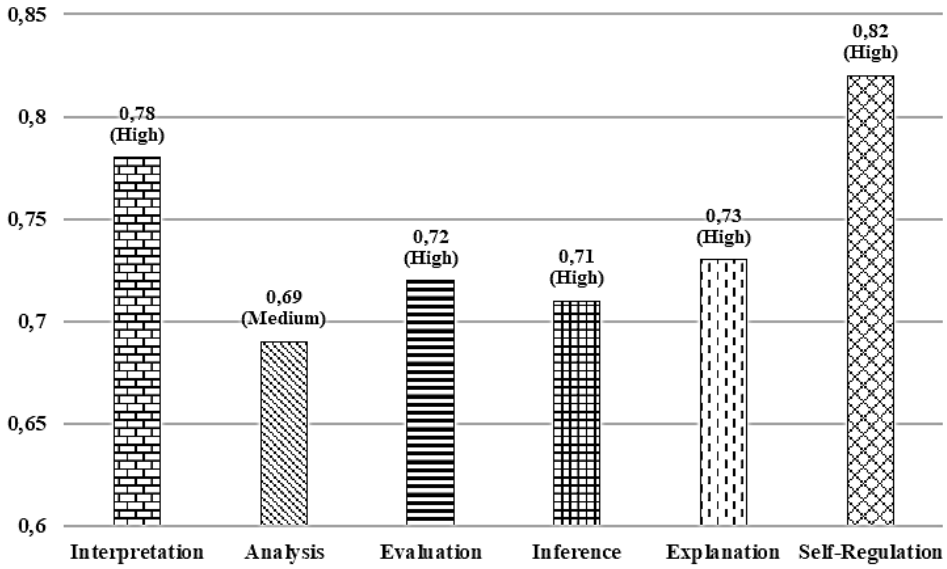

Figure 2. Gain scores for each aspect of critical thinking skills

Statistical analysis is carried out on critical thinking skills obtained from the pre-test and post-test assessments to ensure that the developed media meets the criteria for effectiveness. The study begins with a data normality test whose results are shown in Table 1. Based on the results of the normality test in Table 1, it is known that the value of Sig is 0.000. This value is less than 0.05, so it can be concluded that the pre-test and post-test values are not normally distributed. Then, we used a non-parametric statistical

analysis with the Wilcoxon test. The results of the paired sample test on the pre-test and post-test data by applying the Wilcoxon test are shown in Table 2 and Table 3.

Table 1. Result of normality test

Score		Shapiro-Wilk		
		Statistic	**df**	**Sig.**
Critical Thinking Skills	*Pre-test*	.819	30	.000
	Post-test	.792	30	.000

Table 2. Ranks test

		N	**Mean Rank**	**Sum of Ranks**
Post-test Pre-test	Negative Ranks	0[a]	.00	.00
	Positive Ranks	30[b]	15.50	456.00
	Ties	0[c]		
	Total	30		

Note:
a. Post-test < Pre-test
b. Post-test > Pre-test
c. Post-test = Pre-test

The negative ranks column or the difference (negative) between critical thinking skills for the pre-test and post-test is 0, both on the value of N, Mean Rank, and Sum of Ranks. The value 0 indicates no decrease or reduction from the pre-test to the post-test. In the positive ranks column or difference (positive) between critical thinking for the pre-test and post-test, there are 30 positive data (N). It means that 30 students experienced increased critical thinking from pre-test to post-test scores. The mean rank or average increase is 15.50, while the number of positive rankings or Sum of Ranks is 456.00. For the Ties column, the pre-test and post-test values are 0, so it can be said that there are no similar values between the pre-test and post-test.

Table 3. Test statistics

	Post-test
	Pre-test
Z	-4.787[b]
Asymp. Sig (2-tailed)	.000

Note:
a. Wilcoxon Signed Ranks Test
b. Based on negative ranks

Based on the test results in Table 3, it is known that Asymp. Sig. (2-tailed) is 0.000. Because the value of 0.000 is smaller than 0.05, it can be concluded that the alternative hypothesis is accepted. It means that there is a difference between the pre-test and the post-test. Thus, it can be supposed that using scrapbook media in learning science improves the critical thinking skills of junior high school students. Essential features of thinking contained in scrapbook media can assist students in developing aspects of critical thinking. Students can learn to use media to build their ability to appropriately interpret, analyze, evaluate, infer, explain, and self-regulate. Students can carry out science learning activities that lead to the achievement of critical thinking

skills according to the directions in the scrapbook media. With the scrapbook media, students learn to interpret various additives and addictive substances and explain the use of additives in food. Students can also analyze and evaluate the impact of substance abuse of additives and addictive substances, concluding drug use. The content follows the material in the middle school science curriculum.

▪ CONCLUSION

The results of product development in the form of scrapbook media in science learning on material additives and addictive substances to improve junior high school students critical thinking skills achieve an average validity of 86%. The developed scrapbook media includes excellent content and material, language, presentation, and graphics categories. Thus, scrapbook media is suitable for use as teaching material in the science learning process in junior high schools. Product practicality reaches an average usefulness of 98%. It means that the product developed has convenient criteria because it fulfills the implementation in the science learning process. Product effectiveness achieves an N-gain in the high category. Using scrapbook media in science learning on additive and addictive substances can improve students' critical thinking skills. Thus, the developed scrapbook media is declared effective for use in the learning system and can improve students' thinking skills in learning natural sciences in junior high schools. Teachers can use these products in science learning to develop students' critical thinking skills.

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