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The transformation of science-learning: the role of scientific inquiry and interactive technology in elementary schools

Yunita Sari [1], Jupriyanto [2], and Rida Fironika Kusumadewi [3]
[1,2,3] Elementary School Teacher Education, Faculty of Teacher Training and Education, Universitas Islam Sultan Agung, Semarang, Indonesia

Corresponding author's e-mail: yunitasari@unissula.ac.id

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Abstract

Critical thinking skills have an important role in learning science in elementary school. But in reality, science learning in grade V of elementary school has not been optimally directed to develop students' critical thinking skills. The limitations of interesting learning media that are in accordance with the characteristics of elementary children are one of the causes of students' low interest and motivation to learn science subjects The objectives of the research are (1) Producing interactive multimedia with a scientific inquiry approach, (2) Obtaining interactive multimedia feasibility data with a scientific inquiry approach and (3) Obtaining effectiveness test datacritical thinking skills in improving critical thinking skills of elementary school students. This development research uses the ADDIE model, namely: (1) Analysis; (2) Design; (3) Development; (4) Implementation; and (5) Evaluation with mixed method research methodology. The results of the research from expert validation in both aspects of material, media, language, and learning show that interactive multimedia with a scientific inquiry approach is valid for use. The response of teachers and students to interactive multimedia with a scientific inquiry approach is in the category of very good. The effectiveness test by implementing the scientific inquiry approach showed that interactive multimedia science was effective and practical in improving the critical thinking skills of Grade V elementary school students. It can be concluded that interactive multimedia with a scientific inquiry approach can be used as a learning medium to stimulate students to reason and think critically in improving the quality of science learning.

INTRODUCTION

Background of the Study

Critical thinking skills have an important role in science learning in elementary school, because they can familiarize students with high-level thinking and face problems analytically. These skills are essential to assist students in analyzing information, solving problems, and making logical and rational. In the context of elementary school, especially in grade V, the development of critical thinking skills is crucial because students are at the concrete operational stage towards formal, where they begin to be able to think logically and analytically towards various phenomena, including in Natural Science lessons. But in reality, science learning in grade V of elementary school has not been optimally directed to develop students' critical thinking skills. Learning activities tend to emphasize memorizing concepts rather than problem solving, analysis, or evaluation of scientific phenomena that exist around students. These skills are essential to assist students in analyzing information, solving problems, and making logical and rational decisions. This condition is exacerbated by the lack of adequate educational facilities and facilities, so that the quality of graduates in general is still low (Suryana, 2020). As a result, students are less motivated to develop critical thinking skills, which should be an important provision in facing real-world challenges (Isma et al., 2023)

In addition, the learning media used tends to be limited to simple textbooks or teaching aids. In fact, the characteristics of science material are often abstract and require visualization or simulation to help students understand. The limitation of interesting learning media that is in accordance with the characteristics of elementary children is one of the causes of low student interest and motivation to learn science subjects (Intan et al, 2021). In addition, their inability to understand the material presented requires innovative efforts to create more interesting and interactive learning. To overcome these problems, one potential solution is the use of interactive multimedia in learning. This media allows for two-way interaction between students and learning materials so that students can learn actively and independently according to their learning style. Interactive multimedia allows students to learn independently, giving them complete control over the learning experience. In addition, innovation in learning is very important because it can trigger changes in systems that are less effective to changes in a more constructive direction (Fahri, 2022). With attractive visualizations, animations, and interactive features, interactive

multimedia has been proven to be able to increase student engagement and understanding of learning materials (Utami et al., 2025). In the context of education, the use of interactive multimedia opens up new opportunities to create a more interesting, personalized, and effective learning environment (Febriansyah et al., 2021). The use of interactive media in the development of teaching materials contributes to a change in the teacher-oriented learning paradigm to student-centered learning (Sari et al., 2023)

However, the use of learning media alone is not enough. Learning strategies also need to be directed at appropriate approaches, such as Scientific Inquiry. This approach encourages students to learn through direct experience, such as observing, formulating problems, making hypotheses, conducting simple experiments, and drawing conclusions (Yamin et al., 2023). The implementation of this approach shifts the learning paradigm from passive reception of information to the active construction of knowledge and skill development, thus, students not only become consumers of information, but also knowledge producers who are able to relate abstract concepts to real experiences (Maulidia et al., 2023). Meaningful learning, where students learn by working alone, discovering, and constructing new knowledge and skills, is very important (Astuti, 2020). Scientific Inquiry provides opportunities for students to apply knowledge in real-world contexts, solve authentic problems, and develop critical thinking skills (Indrawati et al., 2021).

The integration between interactive multimedia and the scientific inquiry approach is believed to be able to provide a more meaningful learning experience, as well as improve the critical thinking skills of grade V elementary school students, especially in science subjects. Therefore, this research was conducted with the aim of developing interactive multimedia based on scientific inquiry on science content as an effort to improve the critical thinking skills of grade V elementary school students.

The Problem of The Study

The above background is also strengthened by a preliminary study conducted by giving test questions to 20 grade V elementary school students. This test is used to determine students' critical thinking skills, the test given is in the form of case study-based description questions that are in accordance with the science material for grade V of Elementary School. The test results show that 60% of students still have not completed the KKM. This is the basis for research and finding solutions in improving students' high-level thinking skills in science subjects. In addition to conducting tests, interviews were also conducted with 5 5th grade teachers to find

out the causes of students' low critical thinking skills. The results of the interviews obtained showed that students' critical thinking skills were low influenced by the limitations of monotonous science material delivery and teachers were not used to using problem-solving problems, evaluation questions were more dominant in comprehension questions. Meanwhile, the results of interviews with 20 students stated that there were some materials that could not be understood because they were abstract.

Research's State of the Art

The role of multimedia can facilitate conceptual understanding and can increase children's concentration (Maulana et al., 2025; Pratiwi et al., 2020). The use of multimedia in learning involves visual, audio, and movement elements, which can accommodate a variety of student learning styles, making the learning experience richer and more meaningful. With multimedia, abstract material can be visualized into a more real and easy-to-understand form (Yanto et al., 2023). Learning media functions as a bridge between teachers and students, ensuring more effective and engaging material delivery, so that students are motivated and actively involved in the learning process (Amalia, 2022; Utami et al., 2025). There is a positive relationship between openness to experience and learning outcomes which shows that students are more open and perform better in multimedia-based learning. The integration of multimedia into the learning environment in elementary schools not only offers transformative opportunities but also fundamentally transforms the learning experience, potentially enhancing various aspects of learning (Pratiwi et al., 2020). The integration of technology in learning is important to increase the effectiveness of the teaching and learning process and improve the quality of education in order to create an attractive environment for students' learning experiences. Digital devices offer a wide range of benefits in learning, including the ability of students to organize information into different cognitive structures, both visual and auditory (Syahid et al., 2022). The use of visually and functionally engaging learning media can increase students' focus and spark their curiosity about the material being presented. The use of digital media in education has been shown to be effective in facilitating independent learning, exploration, and knowledge building through interaction with various sources of information. Based on the *state of the art* above, most of the research shows that interactive multimedia can stimulate students' thinking and increase effectiveness by integrating problem-solving models.

Novelty, Research Gap, & Objective

This research has a novelty in the development of interactive multimedia science which is specifically designed based on *the Scientific Inquiry* approach to improve the critical thinking skills of grade V elementary school students. Different from learning media that generally only present informative content, this multimedia integrates the stages of scientific investigation that encourage students to observe, formulate problems, design experiments, and draw conclusions independently. The research gap was identified from the limited science learning media at the elementary school level which is explicitly designed to train critical thinking skills through *the Scientific Inquiry* approach. Many previous studies have focused on aspects of knowledge or media use in general, but have not touched deeply on the integration of scientific inquiry approaches in the development of interactive multimedia. Therefore, the objectives of this study are: (1) developing interactive multimedia science based on *Scientific Inquiry* to improve the critical thinking skills of grade V elementary school students; (2) analyze the feasibility of the multimedia both in terms of content, design, and technical use; and (3) to examine its effectiveness in improving students' critical thinking skills after the use of media in the learning process.

METHOD

Type and Design

This development research uses the ADDIE model with *a mixed method research methodology.* In this study, learning media products were produced and tested for effectiveness to determine the feasibility of the product. The learning media developed is in the form of interactive multimedia with a scientific inquiry approach. The development design uses the ADDIE model. Branch (2020) explained the stages in the ADDIE model, namely: (1) *Analysis*; (2) *Design*; (3) *Development*; (4) *Implementation* and (5) *Evaluation*.

Data and Data Sources

The sample in this study was grade V students of Tulis District, Batang Regency who were randomly selected. The sampling technique uses *simple random sampling* techniques. The elementary schools that were represented were SDN Beji 01 and SDN Beji 03. The subject was 35 students. The design of this study is an experiment with *a one group pretest-posttest design.*

Data Collection Technique

Data collection techniques are divided into two types, namely test and non-test. The data collection test technique is in the form of critical thinking skills test results while the non-test data collection is in the form of giving a questionnaire. Questionnaire data obtained from the validation of expert feasibility tests and student feasibility tests.

Data Analysis

The data analysis technique used for quantitative data on the results of the validation questionnaire was analyzed using the Likert scale. After the questionnaire is validated by the validator, the questionnaire is analyzed and percentaged. Sugiyono (2010) said that the average percentage of each component is calculated using the formula:

$$P = \frac{\sum X_i}{n} \times 100\%$$

where P is the Gain of the validator percentage, $\sum$ xi as the sum of each score, the criterion, and *n* as the maximum number of scores.

Tabel.1 Guidelines for Assessing the Validity of Development Products

Persentase	Validity Criteria	Information
80 – 100	Very valid	Excellent
66 – 79	Valid	Good
55 – 65	Quite valid	Enough
40 – 55	Invalid	Less
30 – 39	Invalid	Very less

User response questionnaires were conducted to measure academic supervision guidelines based on Likert scale and were also analyzed.

Tabel.2 Interpretation of User Response Scores

No.	Percentage (%)	Criterion
1	80 – 100	Excellent
2	66 – 79	Good
3	55 – 65	Pretty good
4	40 – 55	Less good
5	30 – 39	Bad

The data obtained from the test was analyzed by comparing the critical thinking skills score in science learning in *pretest* and *posttest activities* (before and after) using

interactive multimedia whether there was a significant difference in scores. To measure the improvement in children's learning outcomes after being treated using N-gain according to Hake.

$$< g >= \frac{(< \%post > - < \%pre >)}{(100\% - < \%pre >)}$$

Information:

<g> : normalized average gain

%post: Final Test Score

%pre : initial test score

Furthermore, the gain criteria will be determined as shown in the following table:

Tabel 3 Categories Interpretation of *N-Gain Effectiveness*

Gain	Criterion
> 76	Highly Effective
56 - 75	Effective
40 - 45	Less Effective
< 40	Ineffective

RESULTS

The results of the study explain the development process of interactive multimedia interactive multimedia with a scientific inquiry approach starting from needs analysis, design process, development, implementation, and evaluation, as well as testing the effectiveness of interactive multimedia interactive multimedia products with a scientific inquiry approach in science lessons. Furthermore, the discussion section describes the results of the analysis of research and development findings.

1. Interactive Multimedia Development

Analysis of Learning Media Needs

Analysis by conducting interviews with 4 teachers in class V to obtain information about students' learning conditions in the classroom, the use of learning media, and the learning media needed. The results of teacher interviews rarely use learning media during the learning process. In addition, the learning media that is often used by teachers are textbooks from the government and companion books purchased independently as well as learning media in the form of PPT or videos that are already available on the platform. The selection of learning media needs to be adjusted to the learning characteristics of students and relevant materials that can improve students' critical thinking skills, which are relatively low. This condition can

be seen when students are given questions that require critical thinking skills and are unable to answer the questions according to Indicators of critical thinking ability. The use of science learning media with a scientific inquiry approach is a medium that is considered appropriate to be used in the learning of elementary school students.

Learning Environment Analysis

The results of the analysis of the learning environment show that in the learning process carried out it shows that (1) the ability to formulate questions by students is still lacking, (2) the ability to plan problem-solving strategies is still not good. It is seen that students still need help from teachers in solving a problem in learning, (3) the ability to evaluate students in the category is still not able to solve problems, that is, students have not been able to calculate correctly and make conclusions from solving the problem completely.

2. Interactive Multimedia Credentials

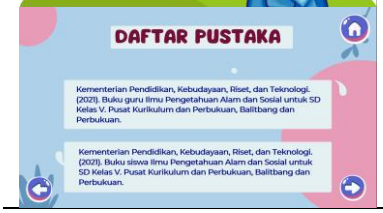
Development Design

In the initial design of the development of learning media with a scientific inquiry approach, the steps taken by the researcher at this stage are, a) Data collection of material materials, layouts, and images, b) *Storyboard*, c) Scientific approach learning media framework.

Interactive Multimedia Development

At the development stage, the researcher uses an *articulate story line application* which is an application to create learning media. Materials and assets are obtained from *cancva* and *freepic.* The creation of media products begins with creating an *articulate story line PPT display* consisting of learning materials, watching videos, games/games and practice questions. The components of the media are; 1) introduction; 2) curriculum; 3) instructions for use; and 4) material. Interactive multimedia images can be seen in table 4

Tabel. 4 Interactive Media of Respiratory System Materials in Humans

Interactive Multimedia	Information
	The cover page displays the media title, *Button icon* to start
	The menu page displays titles, *Button icons,* material identities, educational games, Practice questions/quis and bibliography
	The page displays the title of the material, *Button icon* of the material of the respiratory organs in humans
	The game page features the game of finding respiratory organs in humans
	The quis page contains questions about critical thinking skills about the material of the respiratory system in humans
	This page shows emotion if students answer questions correctly
	The bibliography page contains references in the creation of materials on interactive media.

Subject Matter Expert Validation

Validation of material experts is useful for assessing the suitability of the material in interactive media with a scientific approach. Aspects assessed by subject matter experts include the content of the material, the accuracy of the material and

the feasibility of the material. The results of the material validation of science learning media are presented in the following Table.5

Table.5 Material Expert Validation Results

Aspects	Validator		Maximum score	Percentage		Average	Criterion
	1	2		1	2		
Contents of the material	11	10	12	92	83	88	Very valid
Material accuracy	14	15	16	88	94	91	Very valid
Material Availability	7	8	8	88	100	94	Very valid
Critical thinking	23	23	24	96	96	96	Very valid

Based on Table 5, it is shown that the analysis of material validation of interactive multimedia with a scientific inquiry approach shows that the content of the material, the accuracy of the material, and the feasibility of the material are very valid. However, it needs to be revised in accordance with criticism and suggestions so that it is worth using.

Media Expert Validation

Media expert validation is useful for validating the ease of use, writing, display, and use of interactive multimedia with a scientific inquiry approach. The validation aims to ensure that the developed media can be used and applied in the field without any obstacles in the learning process The results of interactive multimedia validation with a scientific inquiry approach are presented in Table 6 below

Tabel. 6 Media Expert Validation Results

Aspects	Validator		Maximum score	Percentage		Average	Criterion
	1	2		1	2		
Substance	8	7	8	100	88	94	Very valid
User	11	12	12	92	100	96	Very valid
Writing	14	14	16	88	88	88	Very valid
Display	14	15	16	88	94	91	Very valid
Media quality	11	11	12	92	92	92	Very valid

Based on Table 6, it shows that the media validation analysis of the ease of use, writing, display, and use of interactive multimedia with a scientific inquiry approach shows very valid criteria, but needs to be revised in accordance with criticism and suggestions to be valid for use.

Linguist Validation

Linguists provide assessments related to grammatical aspects in interactive multimedia with a scientific inquiry approach. The assessment aspect is language

clarity and communication. The results of linguists' assessment of interactive multimedia with a scientific inquiry approach are presented in Table 7 below

Tabel 7 Linguist Validation Results

Aspects	Validator		Maximum score	Percentage		Average	Kriteria
	1	2		1	2		
Language Clarity	23	22	24	96	92	94	Highly Valid
Communication	11	11	12	92	92	92	Highly Valid

Based on Table 7, it is shown that the analysis of language validation on language clarity and interactive multimedia communicative with a scientific inquiry approach shows very valid criteria, but needs to be revised in accordance with criticism and suggestions to be valid for use.

Implementation of interactive multimedia with a scientific inquiry approach

The implementation stage with trials is the stage of applying interactive multimedia with a scientific inquiry approach to grade V elementary school students. The implementation of learning media was carried out at SDN Beji 01 with a total of 15 students. At this stage, to find out how the role of the scientific inquiry approach in effective learning in delivering respiratory system material to humans. The trial aims to find out whether interactive multimedia with a scientific inquiry approach to science subjects that has been developed can effectively improve students' critical thinking skills. Field-scale trials were carried out using *pretest* and *posttest.* The results of the student test can be seen in table 8

Table 8 Average Pretest and Posttest Scores

Respond	Experimental Classes	
	Prettes	Posttes
15	53	84

After the researcher knows the average results of pretests and postes, next, to find out the effectiveness of interactive multimedia in improving critical thinking skills, the *N-Gain test is carried out.*The results of the *N-Gain score* test were obtained as follows

Table 9 Test Results *N-Gain Score*

Responden	**N-Gain Score**	**N-Gain Persen**	**Interpretasi**
15	0.60	60	Efektif

Based on the table above, it shows that the N-Gain percent in the trial class is 60 with effective interpretation. This means that the use of interactive multimedia with a scientific inquiry approach in the experimental classroom is effective in improving the critical thinking skills of grade V elementary school students.

Meanwhile, to find out the students' responses related to interactive multimedia, a questionnaire was given. The results of the questionnaire of students' responses to interactive multimedia with a scientific inquiry approach in science subjects are presented in Table 10 below

Tabel 10 Student Response

Student	Aspects	item	Maximum score	Scores obtained	Percentage	Criterion
15	Material	4	60	54	90	Excellent
	Language	2	30	26	87	Excellent
	Display	5	75	70	93	Excellent
	Implementation	4	60	55	92	Excellent

Based on the table above, it shows that the students' response in the trial class obtained very good criteria. This means that the use of interactive multimedia with a scientific inquiry approach is good to be used in improving the critical thinking skills of grade V elementary school students.

3. Evaluation

The results of the interactive multimedia evaluation with a scientific inquiry approach in science subjects to improve critical thinking skills are as follows. The results of the recapitulation of the expert assessment show that interactive multimedia with a scientific inquiry approach in science subjects is a very valid criterion to be used. The results of students' responses to the application of interactive multimedia with a scientific inquiry approach in science subjects showed very good criteria. Students really like and are enthusiastic when using learning media, students like to use learning media, students find learning more exciting, fun and not boring when using media, and students easily capture learning materials by using interactive multimedia with a scientific inquiry approach in science subjects.

After using interactive multimedia with a scientific inquiry approach in science subjects was completed, the teacher gave a response regarding the use of interactive media in science subjects. The results of the teacher's response were used to assess the ease and implementation of media in learning. The results of the teacher's response were reviewed from the aspects of implementation, media display, language, and materials. The results of teachers' responses to interactive multimedia with a scientific inquiry approach in science subjects showed very good criteria. The use of media makes it easier for students to understand the learning material and suggests that the display of learning media is even more interesting to make students more enthusiastic about participating in learning activities. The results of *the N-Gain* test for the use of interactive multimedia media with a scientific inquiry approach in

science subjects, show that the average *value of N-Gain* of the trial of 60% is included in the effective category, so it can be concluded that the use of interactive multimedia with a scientific inquiry approach in science subjects is effective in improving the critical thinking skills of elementary school students.

The effectiveness of interactive multimedia with a scientific inquiry approach

Application of interactive multimedia with a Class V scientific inquiry approach on respiratory system materials. The field scale test aims to find out whether interactive multimedia with a scientific inquiry approach to science subjects developed is effective and can improve students' critical thinking skills. The results *of the pretest* and *posttest* were then calculated to obtain effective keriteria with the N-gain test.

The *N-Gain test* is used to determine the effectiveness of a particular treatment in a study. The *N-Gain* test is used to determine whether the application of interactive multimedia with a scientific inquiry approach in science subjects is effective in improving the critical thinking skills of elementary school students. The basis for decision-making is guided by the following Table 11.

Table 11 Average Pretest and Posttest Scores

Respond	Class V	
	Pretes	Posttes
20	60	87

After the researcher knows the average results of pretests and postes, next, to find out the effectiveness of interactive multimedia in improving critical thinking skills, the *N-Gain test is carried out.*The results of the *N-Gain score* test were obtained as follows

Table 12 Test Results *N-Gain Score*

Respond	**N-Gain Score**	**N-Gain Percent**	**Interpretasi**
20	0.68	68	Effective

Based on the table above, it shows that the N-Gain percent is 68 with effective interpretation. This means that the use of interactive multimedia with a scientific inquiry approach is effective in improving the critical thinking skills of grade V elementary school students. Meanwhile, to find out the students' responses related to interactive multimedia, a questionnaire was given. The results of the questionnaire of students' responses to interactive multimedia with a scientific inquiry approach in science subjects are presented in Table 13 below

Tabel 13 Student Response

Student	Aspects	item	Score max	Score	Percentage	Criterion
20	Material	4	80	75	94	Excellent
	Language	2	40	37	92	Excellent
	Display	5	100	94	94	Excellent
	Implementation	4	80	74	92	Excellent

Based on the table above, it shows that the students' responses in the field-scale test class obtained very good criteria. This means that the use of interactive multimedia with a scientific inquiry approach is good to be used in improving the critical thinking skills of grade V elementary school students. After learning using interactive multimedia with a scientific inquiry approach in science subjects is completed, teachers provide responses related to the use of interactive multimedia with a scientific inquiry approach in science subjects. The results of the teacher's response were used to assess the ease and implementation of media in learning. The results of teachers' responses to interactive multimedia with a scientific inquiry approach in science subjects can be seen in Table 14 below

Tabel 14 Teacher's Response

Respond	Aspects	Item	Maximum score	Scores obtained	Average	Criterion
1	Content quality	8	32	30	94	Very valid
	Language	5	20	18	90	Very valid
	Implementation	6	24	22	92	Very valid
	Display	6	24	22	92	Very valid

Based on the table above, it shows that the teacher's response was obtained as a very good criterion. This means that the use of interactive multimedia with a scientific inquiry approach is good to be used in improving the critical thinking skills of grade V elementary school students.

DISCUSSIONS

Learning conditions in elementary schools have various problems, including learning that is still teacher-centered, so that students do not play an active role and learning goals have not been achieved optimally, because teachers still do not use more interactive learning media. This method, while foundational for imparting basic knowledge, often neglects the cultivation of deeper understanding and collaborative skills essential for addressing complex, real-world challenges (Bhardwaj et al., 2025). It would be better if the teacher always understood the needs of the students in learning and supervised every student activity. So that what is an obstacle can be

solved appropriately and pay attention to the condition and concentration of students so that they can take over their attention and increase it when they have difficulty thinking and understanding the material. Through the use of interactive multimedia with a scientific inquiry approach in science subjects, it can help learning objectives to be achieved optimally and be able to create active learning. Learning media is a tool that helps the teaching and learning process so that it can achieve learning goals better and perfectly. Learning media acts as an essential intermediary between teachers and learners, allowing for more effective information delivery and in-depth understanding in an educational environment (Rachmawati et al., 2023). Learning media plays a dual role as a tool and a representative of teachers, ensuring that information is presented accurately, clearly, and interestingly (Rahmawati & Sibuea, 2021). In addition, the use of learning media can also improve the skills that students have, one of which is the ability to think critically of students. Like literacy, critical thinking skills are one of the skills that students must master in the 21st century because they are included in the 4Cs (*Critical Thinking, Communication, Collaboration, Creativity*) skills. Each individual's critical thinking skills are different, but these skills can be trained from an early age. This ability is very important to develop because it functions to formulate or solve problems and also make decisions in daily life. In addition, the purpose of science learning that requires students to be able to think critically until now has not been implemented optimally (Fitriana, 2021). In fact, critical thinking skills are very important to be developed in students because they can improve the skills of expressing ideas that help improve understanding.

The critical thinking skills of students are still moderate. Some obstacles in the learning process are that students are only able to do types of questions that are categorized as easy and moderate, if students are given questions that are classified as difficult and require high analysis, students still have difficulties. Andayani et al., (2023) stated that stating that assessments that are more focused on learning outcome assessment cause assessments of the learning process to be neglected and inappropriate. As a result, students struggle to connect and apply knowledge in real-life contexts if they rely solely on memorization without deep understanding. Because what happens in the field is that the assessment is only focused on assessment or the final product of learning so that students' ability to solve the problems faced has not been presented in the learning process. Finally, many learning activities in schools are surrounded by the problem of low student understanding and the level of students' critical thinking skills. Learning is said to be successful if students really understand

the material given by their teachers, not how good the grades obtained by the students.

The interactive multimedia design with a scientific inquiry approach to science subjects was developed with the aim of improving students' critical thinking skills. Interactive multimedia science learning media with a scientific inquiry approach developed by the researcher has an attractive appearance, clear material, and media design is adjusted to the level of student development. This media is able to involve students to be active in learning. Student activity is all positive student activities during the learning process, both physical and non-physical (mental) and can be accounted for so that it has a good impact on the learning process and the end of learning (Putri et al., 2020). Student activeness in learning can be increased through various efforts, one of which is by improving the learning process itself. Learning media has several crucial functions in supporting the effectiveness of the teaching and learning process, including attention, affective, cognitive, compensatory, and evaluative functions. Learning media serves as an intermediary that bridges the communication gap between teachers and students, ensuring that learning messages are conveyed clearly and effectively.

The function of learning media is as a source of teaching and learning activities, as a learning aid, attracting attention and motivation in learning, generating passion or interest in learning in students, improving students' learning processes and outcomes, reducing the occurrence of verbalism in learning activities, as a guide in learning, and overcoming the limitations of space, time, energy and sensory power. When students are interested and motivated in learning, it will make learning more meaningful and students' needs will be met. Teachers as facilitators also need to provide enthusiasm and motivation to students through learning media. The criteria for choosing a good learning media are the suitability of the goals, topics given and learning objectives, having decent and good quality, adjusting the level of ability of students and teachers as media users, can increase students' creativity and skills, and attractive designs so as to arouse students' interest, attention and motivation to learn. The existence of these media selection criteria makes it easier for teachers to use media according to the needs and characteristics of students so that they can achieve the desired learning goals (Amalia, 2022).

The results of the validation are suggestions and comments from material experts on interactive multimedia with a scientific inquiry approach in science subjects, namely the material contained in interactive multimedia with a scientific

inquiry approach in science subjects needs to be shortened or points made to make it easier for students to understand the material presented. Furthermore, suggestions and comments from media experts, namely changes in the appearance of the media, include image size, image captions, and symbols or icons on the media. In the writing section, it is necessary to re-select the color, typeface and font size to make it easier to read. Meanwhile, suggestions and comments from linguists are the choice of words that must be adjusted to the characteristics of students. Then, suggestions and comments from practitioners, namely media displays, should be equipped with instructions so that they are easy to use.

Based on the results of assessments by material experts, media experts, linguists and practitioners on interactive multimedia with a scientific inquiry approach in science subjects, the criteria are very valid. So it can be concluded that interactive multimedia with a scientific inquiry approach to science subjects that is developed meets the category of being very valid for use in learning. Learning media has several benefits when used in learning activities. The benefits of media include the following: (1) The use of learning media in teaching and learning activities can improve teachers' skills as professional educators so that they focus on the material learned, (2) Media provides careful and up-to-date guidelines, (3) With the media, the learning process becomes fun and not boring, (4) Saves time, (5) Can give rise to students' confidence, (6) Adding to students' real experience, (7) Media improves student learning efficiency, and (8) Media can help solve problems that occur in the world of education. Learning media is a tool for students in learning so that students can understand the material delivered faster by the student's teacher (Amalia, 2022). Teachers are required to develop creativity in using learning media. Interactive multimedia with a scientific inquiry approach to science subjects can be the right choice for teachers today. Interactive multimedia has great potential to stimulate students to be able to respond positively to the learning material presented, because it is an innovative learning medium and very interesting for students, so that students are motivated to actively participate during the learning process (Fitra, 2022). Learning media acts as an effective vehicle for educators in transmitting teaching materials, as well as accelerating students' level of understanding of complex concepts. A learning is said to be successful if students really understand the material given by their teachers, not how good the grades obtained by the students.

Based on the results of the N-Gain test, it shows that the average value of N-Gain is included in the effective category. So it can be concluded that the use of interactive multimedia with a scientific inquiry approach in science subjects is effective in improving the critical thinking skills of elementary school students. Therefore, it is concluded that there is an influence of the application of interactive multimedia with a scientific inquiry approach in science subjects on the critical thinking ability of elementary school students. Further studies also substantiate that student-centered learning methodologies, particularly those incorporating interactive and collaborative elements, actively engage students, thereby fostering deeper understanding and improved academic outcomes (Kiat et al., 2020). The integration of technology, particularly interactive multimedia, within the pedagogical framework of science education has been shown to be a potent tool for cultivating higher-order thinking skills, as evidenced by enhanced critical thinking abilities among elementary school students (Najikhah et al., 2022). The application of interactive multimedia within a problem-based learning environment, for instance, has been specifically linked to significant improvements in critical thinking skills, highlighting the importance of instructional design that promotes active interpretation and evaluation of information.

CONCLUSION

Based on the results of the research and discussion, the conclusions of the interactive multimedia development research with a scientific inquiry approach in science subjects are as follows: (1) The interactive multimedia media model with a scientific inquiry approach in science subjects developed in this study is designed to provide an interesting interactive experience for users. (2) Based on the feasibility test of interactive multimedia with a scientific inquiry approach by 6 experts consisting of 2 material experts, 2 linguists and 2 media experts, it is stated that interactive multimedia with a scientific inquiry approach is very valid to be used as a science learning medium for grade V elementary school students. (3)Based on the practical results of the teacher's and students' responses through the analysis of learning implementation data and user responses, the results of the teacher's responses were obtained in the very good category, and the students' responses provided information that the practicality was in the very good category. (4) Based on the results, the N-Gain percent on the field scale is 68 with effective interpretation.

This means that the use of interactive multimedia with a scientific inquiry approach in the classroom is effective in improving the critical thinking skills of grade V elementary school students.

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