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The Effect of Web-Based Interactive Learning Media on Critical Thinking Skills of Elementary School Students

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Abstract: Learning media has an important role in developing students' abilities. However, the use of learning media is still low, especially in developing students' critical thinking skills. This research aims to determine the differences in critical thinking abilities between students who are taught using web-based interactive learning media and classical learning, and the effect of applying web-based interactive learning media on students' critical thinking abilities. It used quasi-experimental research. The research population only consisted of fifth-grade students at Sawur Elementary School. In the experimental group the learning process took place using web-based interactive learning media, while in the control group it took place classically. The instruments used are tests that measure students' critical thinking abilities in the cognitive aspect and behavioral scales that measure students' critical thinking abilities in the behavioral aspect. The data was then analyzed using: (1) descriptive statistics to describe critical thinking skills and learning outcomes, and (2) inferential statistics using the Independent Sample t-test and Paired Sample t-test to test the research hypothesis at a significance level of 5% ($\alpha = 0.05$). The results of the research show that: (a) there is a significant difference in students' critical thinking abilities between the group taught using web-based interactive learning media and the group taught using classical learning, and (b) the implementation of web-based interactive learning media has a positive and significant effect on students' critical thinking skills, with a significance value of 0.005. The implication of the study reveals that web-based interactive learning media notably enhances students' critical thinking abilities in comparison to conventional teaching methods.
Keywords: web-based interactive learning media, critical thinking skills, classical

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Introduction

The increasing development of science and technology in the digital era has greatly encouraged renewal efforts to utilize technological results in various fields, one of which is the field of education. This will encourage everyone to move forward and not want to be left behind. One of them is towards a better educational process. The digital era is a change in a situation where technology becomes the main reference that drives the development of educational science (Julita, 2022). These technological developments also have an impact on the field of education, meaning that teachers today must be able to adapt to using tools that support the smooth teaching and learning process.

Apart from that, teachers are also required to be able to explain or provide material to students using digital-based learning media. In developing learning media, it must be adapted to the existing curriculum to achieve learning objectives. In order for learning to run optimally, it is necessary to carry out an interaction process between teachers and students by applying approaches, models, and learning media that suit students' needs (Poerwanti et al., 2018; Pramana et al., 2020)

Media is a means of transmitting information that the source will convey to the recipient of the message. The use of learning media is very helpful in the learning process and delivering learning material in an interesting way (Apriansyah, 2020). The use of creative learning media can support the

success of the learning process (Astuti et al., 2019). Learning media with many variations is created to help educators in conveying lesson material (Pertiwi & Irfan, 2021)

Interactive learning media is a container or place to convey information to students (Wandah Wibawanto, 2017). Creating interactive learning media in teaching activities can help teachers further improve the quality of students' enthusiasm for learning at school. This interactive learning media is increasingly developing over time and technology. Apart from being a tool to help teachers in conveying learning material, media also facilitates students' understanding of learning material (Erwin et al., 2019; Munthe, 2019).

One of the thematic subjects that requires critical thinking skills is science. Critical thinking skills are important for students (Purwaningsih et al., 2021). The ability to think critically is highly needed, thus, it should be taught in schools (McPeck, 2017; Lastriningsih, 2017). They become an important educational goal to prepare students to be able to identify and analyze the credibility of sources of information, demonstrate prior knowledge, make a connection, and draw conclusions (Duron et al., 2006; Welch et al., 2015). Science education refers to providing experiences to improve students' skills so they can scientifically recognize the natural environment (Devi & Bayu, 2020). Science is also an abstract subject, so sometimes it is difficult for students to understand, so learning does not run effectively. Learning media is required to concretize the material (Suhendro, 2020).

Currently, some teachers still give lessons to students in book form at school. This is what causes students to be less interested in the lessons given by teachers at school because what is displayed is only text and cannot be visualized, which causes a student to get bored looking at the appearance of books which are monotonous and only black and white and cannot move. (Rozy, et.al., 2023) This is one of the biggest factors in education, which causes interest in learning to decrease (Suryanti, 2020).

The results of interviews and observations carried out by researchers also found that teachers still rarely use learning media by utilizing technology. This is due to the limited knowledge of teachers in creating learning media. Learning materials and the test items in these textbooks lack the development of the student's critical thinking skills and even toward understanding the learning materials (Triwahyuningtyas et al., 2020; Masfufah & Wibowo, 2024; Anriana et al., 2024). The learning carried out only uses books owned by students, and communication between teachers and students is carried out only using the WhatsApp application, causing students to become bored easily and unable to study independently because they are unable to understand the material provided. The consequences of a less-than-optimal learning process have an impact on student learning outcomes.

Learning outcomes and learning processes determine successful learning (Kurniawan et al., 2017). Several alternative solutions can be implemented effectively to improve learning. First, various interactive learning models (Pingge et al., 2023; Setyawan et al., 2023). Second, integrating technology in learning, such as multimedia, educational applications, and online learning resources, can make the material more interesting and relevant (Djuwari, 2024; Safitri et al., 2023; Nurhikmah & Wibowo, 2024). Third, developing creative and contextual learning media, such as videos, educational games, and simulations, can help students better understand abstract concepts (Ariesta, 2019; Kristanti et al., 2022). The learning model is the most effective solution for improving the quality of learning because it is able to increase student engagement, motivation, and learning outcomes while meeting diverse learning needs and creating many meaningful learning experiences (Maghfiroh, 2022; Santoso et al., 2024; Halimah & Wibowo, 2024). Using innovative learning models often involves technology and media relevant to students' lives (Albina et al., 2022; Resti & Wibowo, 2024). Not only does this make the subject matter more engaging, but it is also easier to understand and apply in real-world contexts (Ngatman, et.al., 2024).

To overcome this problem, the solution that can be provided is by creating interactive learning media that can increase student enthusiasm and interest. Because the play-based learning approach is very suitable for use in elementary schools (Djatmika et al., 2017; Brilatin & Wibowo, 2024; Efendi et al., 2024). Elementary school students still love to play, therefore teachers should design their lessons that integrate learning material and game (Fitriyadi et al., 2021; Viantorus et al., 2024; Wibowo et al., 2023). Learning media is web-based interactive learning media. In this media, various components are adapted to the characteristics and needs of students. Learning that utilizes technology can make learning activities more enjoyable and increase students' interest in understanding the material provided (Toding & Wibowo, 2024; Harokah et al., 2024; Awaliyah et al., 2024). The difference between this media and the others is that this media is based on a website created with the help of Google Sites, which has

material on the solar system for sixth-grade elementary school students. The advantage of this research is that this learning media can be accessed anywhere online. Apart from that, creating this media can also help students become more independent and clarify abstract material's content into concrete.

Based on the background of the problem, the formulation of the research problem in this study is: (a) is there a difference in the critical thinking abilities of sixth-grade students between classes taught using web-based interactive learning media and classes taught using classical teaching methods in science subjects, and (b) does the implementation of web-based interactive learning media have an impact on students' critical thinking abilities in sixth grade in science subjects?

This research aims to determine the differences in the critical thinking abilities of sixth grade students between classes taught using web-based interactive learning media and classes taught using classical teaching methods in science subjects, and the impact of implementing web-based interactive learning media on grade students' critical thinking abilities.

Methods

This study used a quantitative approach. The type of research carried out was quasi-experimental, namely a quasi-experimental design known as pretest-posttest control group design. Research activities were carried out at Sawur elementaryschool, Ponjong, Gunungkidul. The time for implementing research activities begins in Semester II of the 2023/2024 academic year, in April 2024.

Furthermore, the population of this study was all sixth-grade students. This research is population research. The number of students is 23 people, 15 men and 8 female students. The sampling technique used in this research is cluster random sampling. Examples are selected from groups that are considered similar and non-hierarchical. This research was conducted in three stages: (1) preparation stage, including field studies consisting of school observations, (2) implementation stage, which includes conducting research starting with a pre-test, and (3) evaluation stage, including concluding the post-test for determine if there is an influence of web-based interactive learning media. The experimental design used was a pre-test-post-test control group design.

The data in this study was collected using two methods: tests and questionnaires. Tests used to measure students' critical thinking abilities. The test questions are open questions, totaling ten items. A questionnaire was developed to assess students' critical thinking abilities based on aspects of their behavior in critical thinking. Data collection in this research was carried out at the pre-research and research process phases. In the pre-research stage, data was collected through interviews and observations during the ongoing learning process research. Data collection techniques during the experimental research process include pre-test (before treatment) and post-test (after treatment). To analyze the data, quantitative data was analyzed using Paired Sample t Test, and Independent Sample t Test by first carrying out prerequisite tests in the form of normality and homogeneity tests.

Results and Discussion

Results

Critical thinking skills test data includes pre-test and post-test data from the control and experimental groups. Pre-test data shows that the initial situation is related to students' abilities. Critical thinking skills in both the control and experimental groups before implementing intervention learning. Post-test data reflects the situation of students' critical thinking abilities after intervention learning. The results of the data on critical thinking skills are presented in the following table.

Table 1. Data on Critical Thinking Skills

Description	Control Group (n=23)		Experimental group (n=23)	
	Pre-test	Post-test	Pre-test	Post-test
Mean	73.2174	76.8696	72.8696	83.6087
Std. Deviation	8.25148	5.97954	8.34105	8.94295
Variance	68.087	35.755	69.573	79.976
Minimum	58.00	70.00	58.00	65.00
Maximum	92.00	92.00	92.00	100.00

Based on available data, the average pre-test score of the control group was 73.2174, with scores between 58.00 and 92.00. The experimental group showed an average pre-test score of 72.8696, ranging from a minimum score of 58.00 to a maximum score of 92.00. After the intervention, the control group showed an average post-test score of 76.8696. The minimum score observed was 70.00, while the maximum score reached 92.00. The experimental group showed an average post-test score of 83.6087, ranging from a minimum score of 65.00 to a maximum score of 100.00.

Based on the findings obtained from the pre-test and post-test assessments, it can be seen that the average score of critical thinking abilities showed an increase in the control group, increasing from 73.2174 to76.8696. The average critical thinking skills score of the experimental group showed an increase from 72.8696 to 83.6087. Based on the comparison of the increase in scores observed in the control and experimental groups, it can be concluded that the experimental group showed a more substantial increase in critical thinking abilities compared to the control group.

The normality test and homogeneity test are required as prerequisite tests in the t-test. The normality test aims to find out whether the research subject comes from a normal distribution. The Kolmogorov-Smirnov method uses the SPSS for the Windows program for the normality test. The hypothesis proposed to measure normality is as follows.

Ho: Data is normally distributed.

Ha: Data is not normally distributed.

If the significance value obtained is greater than the specified alpha (> α), namely 0.05 then accepted. Likewise, if the significance value obtained is smaller than the specified alpha (<α) then it is rejected. The results of the normality test for critical thinking skills variables in the control class and experimental class are presented in Table 2 below.

Table 2. Normality Test Data

Variable	Sig. Kolgomorov-Smirnov Data Group				Asymp Sig. (2-tailed)	Description
	Control Group (n=23)		Experimental group (n=23)			
	Pre-test	Post-test	Pre-test	Post-test		
Critical thinking skills	0.968	0.764	0.514	0.984	Sig. > 0.05	Normal

The presented data shows that the significance value obtained for the critical thinking skills variable in the pre-test and post-test for both the control and experimental groups was greater than the specified alpha level. Therefore, the null hypothesis (Ho) is accepted, which indicates that all data are normally distributed.

Table 3. Summary of Homogeneity Test

Variable	Levene Statistic	Df1	Df2	Sig	Description
Critical thinking skills	0.032	1	44	0.263	Homogen

The table shows that the significance values for the variable of critical thinking skills in the control and experimental groups obtained from the pre-test are greater than the specified alpha level. Thus, Ho is accepted, and it can be concluded that all variable variances are equal (homogeneous).

Table 4. Summary of Paired Samples Test

		t	df	Sig. (2-tailed)
Experimental group	Pretest-Postest	-11.619	22	<.001
Control group	Pretest-Postest	-5.793	22	<.001

In the first part of the output, namely the paired sample test, it can be seen that the pre-test average for the experimental class respondent group was 72.8696, while the post-test average for the experimental class was 83.6087. In absolute terms it is clear that the experimental class average is different between the pre-test and post-test, to see whether the difference is significant (statistically real)

we have to look at the output of the second part (independent sample t-test). In the second part of the SPSS output, it can be seen that the t value is -11.619 with a probability <0.001 (two tail) less than 0.05. So, it can be concluded that Ho is rejected, and Ha is accepted or the post-test results in the experimental class are better than the pre-test results in the experimental class at a significance level of 0.05.

In the second part of the output, it can be seen that the pre-test average for the control class respondent group was 73.2174, while the post-test average for the control class was 76.8696. In absolute terms, it is clear that the control class average is different for the pre-test and post-test. Therefore, it can be concluded that the application of web-based interactive learning media has a positive and significant effect on the critical thinking abilities of sixth grade students at Sawur elementary school in science.

Discussion

Based on the data analysis above, it is concluded that students can develop critical thinking through web-based interactive learning media. The use of interactive multimedia can improve students' knowledge and understanding of learning (Kawuryan et.al., 2022; Mustadi, et al., 2024; Liswantiani et al., 2024). Interactive multimedia has an easy and logical presentation of information and is supported by examples such as images, animations, videos, and quizzes that are relevant to the information being studied (Pratiwi & Wiarta, 2021; Sa'adah, et.al., 2020)). Elements in interactive multimedia help students obtain more meaningful information, increasing the brain's capacity for storing information (Elindasari et al., 2024; Mustadi et al., 2023). In addition, this interactive multimedia is very practical. There are many benefits that students get when they use interactive multimedia such as: (1) science information can be presented interestingly and interactively so that it can increase students' interest, motivation and critical thinking skills; (2) providing descriptions and simulations that help students understand complex science concepts; (3) providing various interactive learning activities such as games and quizzes that can help students learn independently; and (4) provide feedback on student learning progress (Juhriah et al., 2024). Students can see, hear, and interact well using interactive learning media (Ismawati et al., 2023). This interactive learning media can also create an atmosphere in the learning process that is more varied and interesting because students can communicate with each other and answer questions presented in the media.

This is what causes the results in the experimental class in the indicator to obtain higher results compared to the control class because the experimental class is supported by learning media that can support students' critical thinking skills. This use can also increase students' motivation to learn (Hotimah & Muhtadi, 2018) If the media is easy to use or access, students will be more willing to return to the material that was presented outside of the classroom. Students can access web-based interactive learning media anywhere online. Apart from that, this media can also help students become more independent and can clarify the content of abstract material into concrete so that science learning becomes more meaningful.

In the learning process using interactive multimedia, students are involved in problem-solving and feel actively involved in finding solutions to their problems (Darmawati et al., 2023; Mustadi et al., 2024; Istiqomah & Wibowo, 2024). This understanding increases students' awareness and encourages them to take concrete actions to solve the problems presented by their teachers. Students' awareness seems consistent with their growing understanding of why certain actions need to be taken and the impact of those actions.

Conclusion

Based on the results of the research and discussion above, it can be concluded that the average pre-test and post-test of the control class and experimental class, in absolute terms, it is clear that there is a significant difference in the results. Then, there is a significant difference in students' critical thinking abilities between the group taught using web-based interactive learning media and the group taught using classical learning. Implementing web-based interactive learning media positively and significantly affects students' critical thinking skills. The learning process has encouraged students to think critically through a series of web-based interactive learning media activities. This makes students more active in learning.

Based on the conclusions, implications, and limitations of the research, the researcher provides

the following recommendations: (1) teachers can provide opportunities to do this by implementing web-based interactive learning media, which can increase the development of students' critical thinking skills by presenting interesting problems to students, (2) for schools it can provide an opportunity to develop teacher expertise with web-based interactive learning media, starting from the planning stage to the student assessment process, (3) for future researchers who conduct similar research, they can develop other material that is more interesting for students with interactive learning media web-based, and (4) for further research it would be useful for researchers to develop observation guides to measure students' attitudes towards critical thinking.

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