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The Effect of Using H5P Interactive Media on Students' Mathematical Critical Thinking Ability

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Abstract
One of the important mathematical thinking skills that students master is critical thinking skills. In fact, students' mathematical critical thinking skills in Indonesia are still relatively low. One of the factors that cause students to have low mathematical critical thinking skills is the use of less creative media. This study was conducted by analyzing the effect of using H5P interactive media on mathematical critical thinking skills. The purpose of this study was to determine the effect of using H5P Interactive Media on the mathematical critical thinking skills of students in grade IX SMP Negeri 1 Ketapang. The samples in this study were students of class IX B as the experimental class and students of class IX C as the control class. The design used was a pretest-posttest control group design. The data of this research is quantitative data obtained from a mathematical critical thinking ability test. Based on the results of hypothesis testing using a t-test with $\alpha = 0.05$, it was found that the increase in mathematical critical thinking ability of students who took part in learning by using H5P interactive media was higher than the increase in mathematical critical thinking ability of students who took part in learning without using H5P interactive media. It can be concluded that the use of H5P interactive media has an effect on students' mathematical critical thinking skills.

INTRODUCTION

In the 21st century, we increasingly face demands for quality resources that can compete. Improving the quality of education is one of the foundations for improving human resources. One of the subjects needed to improve the quality of education is mathematics. Aligns with Government Regulation No. 4 of 2022 on National Education Standards, which requires mathematics in the primary and secondary education curriculum. Permendikbud No. 22 of 2016 states that mathematics lessons have objectives including 1) understanding concepts, explaining and applying concepts accurately, precisely, and efficiently, 2) reasoning, formulating and developing patterns of mathematical properties in preparing arguments and statements, 3) solving mathematical problems, 4) communicate arguments or ideas with diagrams, tables, symbols, or other media in order to clarify problems. Mathematical thinking skills are needed to achieve these goals as part of the thinking process in learning mathematics (Nuryanti, 2022).

One of the important mathematical thinking skills that students master is critical. Critical thinking is a person's ability to think logically and analyze problems and ideas or ideas to make the right decision. The importance of critical thinking is stated in Permendikbudristek RI No. 5 of 2022 concerning the competency standards of secondary-level graduates, one of which is to show the ability to analyze complex problems and ideas, conclude the results, and convey arguments that support their thinking based on accurate data. In addition, 21st-century mathematics learning

emphasizes the importance of developing six aspects of skills known as 6C. The six aspects of skills are critical thinking, creativity, collaboration, communication, character, and citizenship.

The critical thinking skills of students in Indonesia are still relatively low. This is based on the results of the program for International Student Assessment (PISA) in 2022. The results of the PISA study placed Indonesia at the bottom 14 among 81 other countries in the math category, with an average math score of 366, while the average international score was 472 (OECD, 2023). The low critical thinking skills of students in Indonesia are also seen from the results of TIMSS studies in 2003, 2007, 2011, and 2015, which placed Indonesia in the low category (Hadi & Novaliyosi, 2019). Some studies also state junior high school students' mathematical critical thinking skills are still relatively low. Research conducted by Sianturi et al. (2018) shows that students' critical thinking skills are still low due to the lack of student response and the tendency to memorize rather than understand concepts, causing students' critical thinking skills to be less trained. The active role of students is still lacking, which is indicated by the lack of active students in asking questions or arguing. This shows that students tend to focus on the teacher without analyzing, criticizing, or evaluating what the teacher teaches (Arif et al., 2020).

Low critical thinking skills are also found in SMP Negeri 1 Ketapang. This can be seen from the preliminary research test results. Based on the test results, 17,1% or as many as 6 out of 35 students, managed to answer correctly, while the remaining 82,9% or 29 out of 35 students, could not answer correctly. One of the factors that cause students' low critical thinking skills is using less creative media, namely only print-based media in printed books and student worksheets (LKS). This causes students to get bored quickly and be less motivated to learn math.

In response to the above problems, an effort is needed to improve students' critical thinking skills, one of which is the selection of appropriate and more creative media. Choosing the right media can increase student learning motivation and improve students' mathematical critical thinking skills (Nafisa & Wardono, 2019). One of the media that can be chosen is interactive media. Interactive media is media made with a display that fulfills a function to convey information or messages and has interactivity for its users. This is based on research conducted by Zulhelmi et al. (2017), which states that interactive media can improve students' critical thinking skills. Likewise, the opinion of Husein et al. (2015) states that the use of interactive media affects students' critical thinking skills. Interactive media that can be used is H5P interactive media.

H5P interactive media is an HTML 5-based web framework that provides access to a variety of interactive content such as presentations, interactive videos, memory games, quizzes, multiple choice, drag and drop, and others. H5P stands for HTML 5 Package, which is a free, open-source, and responsive framework (National Library Training Center, 2021). H5P is the content and learning materials in the LMS (Learning Management System) e-learning system. It aims to make creating, comparing, and reusing interactive HTML 5 content easier for everyone. The information and interactive learning materials available are based on hypermedia-based content. Hypermedia-based content is Hypertext and multimedia, namely media where information is not only text but also consists of images, sound, video, or multimedia (Hardyanto & Surjono, 2016). Interactive content allows the material to be presented more interestingly, and students participate in responding to the material directly. H5P also allows teachers to provide feedback on students' answers, both correct and wrong. H5P has advantages in terms of its utilization in learning media compared to other applications, one of which is the interactive feature in H5P. Thus, using H5P as a learning media can be more efficient and effective. This is in line with the study of Utari et al. (2022), who conducted research on the utilization of H5P and obtained results showing that H5P learning media is efficient and effective in learning activities. As Amali et al. (2019) also said, with the limitations between teachers and students in interacting in class, H5P is more efficient in overcoming these limitations. H5P can also be used as e-learning that anyone can access and use anytime and anywhere.

METHODS

This type of research is a pseudo-experimental research. The design used was a pretest-posttest control group design. Before being treated, the experimental and control groups were given a pretest to obtain initial data on students' mathematical critical thinking skills. After being treated, the experimental and control groups were given a posttest to obtain final data on students' mathematical critical thinking skills. The samples in this study were of two classes: experimental and control. The experimental class followed the learning with H5P interactive media, and the control class did not use H5P interactive media. Sampling was carried out using the purposive sampling technique, which is a sampling technique with certain considerations (Sugiyono, 2019). The consideration in this sampling is to take two classes with the same teacher, and the average value of the midterm assessment is relatively the same. Furthermore, class IX B with 34 students was selected as the experimental class and class IX C with 35 students as the control class. This research data is quantitative data obtained from the mathematical critical thinking ability test in the form of description questions consisting of 3 questions. The data analysis technique is the increase (gain) of mathematical critical thinking skills. Before conducting the N-Gain data hypothesis test, prerequisite tests were first carried out, namely the normality and homogeneity tests. After the normality and homogeneity tests, it is known that the gain data in the experimental and control classes come from a normally distributed population, and both groups of gain data have the same variance. Furthermore, the equality test of the two means of gain was carried out using the t-test with the help of SPSS software version 22.

RESULTS AND DISCUSSION

Initial Data of Students' Mathematical Critical Thinking Ability

Initial data on students' mathematical critical thinking skills were obtained through the results of pretest scores in experimental and control classes conducted at the beginning of the meeting. After data processing, the initial data on students' mathematical critical thinking skills were obtained as in Table 1.

Table 1. Initial Data of Students' Mathematical Critical Thinking Ability

Class	Many Students	Average	Lowest Score	Highest Score	Standard Deviation
Experiment	34	4,85	0	14	3,60
Control	35	4,40	0	11	3,21

Ideal Maximum Score = 48

Table 1 shows that the initial average of students' mathematical critical thinking ability in the experimental class is higher than the initial data of students' mathematical critical thinking ability in the control class. In addition, the standard deviation for the initial score of mathematical critical thinking ability in the experimental class is higher than the control class. This shows that the distribution of the initial score of students' mathematical critical thinking ability in the experimental class is more diverse than in the control class.

Final Data of Students' Mathematical Critical Thinking Ability

The final data on students' mathematical critical thinking skills were obtained through the results of the posttest scores in the experimental and control classes, which were carried out at the end of the meeting. After data processing, the final data on students' mathematical critical thinking skills were obtained, as shown in Table 2.

Table 2. Final Data of Students' Mathematical Critical Thinking Ability

Class	Many Students	Average	Lowest Score	Highest Score	Standard Deviation
Experiment	34	24,85	8	39	8,62
Control	35	17,89	7	31	6,79

Table 2 shows that the final average of students' mathematical critical thinking ability in the experimental class is higher than the final data of students' mathematical critical thinking ability in the control class. Likewise, the standard deviation for the final score of mathematical critical thinking ability in the experimental class is higher than the control class. This shows that the distribution of the final score of students' mathematical critical thinking ability in the experimental class is more diverse than that of the final score of students' mathematical critical thinking ability in the control class.

Gain Data of Students' Mathematical Critical Thinking Ability

Data analysis of students' mathematical critical thinking skills was conducted to determine the improvement of students' mathematical critical thinking skills in experimental and control classes. Table 3 presents a recapitulation of data on the gain of students' mathematical critical thinking ability obtained from experimental and control classes.

Table 3. Gain Data of Students' Mathematical Critical Thinking Ability

Class	Many Students	Average	Lowest Score	Highest Score	Standard Deviation
Experiment	34	0,47	0,11	0,78	0,18
Control	35	0,31	0,02	0,62	0,16

Table 3 shows that the average gain of students' mathematical critical thinking ability in the experimental class is higher than in the control class. Similar to the average gain, the standard deviation of students' mathematical critical thinking ability in the experimental class is higher than in the control class. This shows that the distribution of data on the gain score of students' mathematical critical thinking ability in the experimental class is more diverse than the distribution of data on the gain score of students' mathematical critical thinking ability in the control class.

Normality Test

The normality test is used to determine whether the data in the two groups come from a normally distributed population or not. This test uses the Software Statistical Package for Sosial Sciences (SPSS) version 22.

The results of the normality test of the data on the gain of students' mathematical critical thinking skills are presented in Table 4.

Table 4. Recapitulation of Data Normality Test Result Gain Test Result

Class	*Statistic*	Df	*Sig. Shapiro Wilk*	Test Decision
Experiment	0,963	34	0,306	H_0 Accepted
Control	0,967	35	0,366	H_0 Accepted

Based on the results of the normality test of the gain data, the test decision for the experimental and control classes is accepted, which means that the gain data of the mathematical critical thinking ability of the experimental class and the gain data of the mathematical critical thinking ability of the control class come from a normally distributed population.

Homogeneity Test

After the normality test is carried out on the data on the gain of students' mathematical critical thinking skills, the homogeneity test will be carried out to determine whether the data from the two groups have the same variance or not. This test uses SPSS 22 Software.

Table 5 presents the results of the homogeneity test of students' mathematical critical thinking ability gain data.

Table 5. Recapitulation of gain data homogeneity test results

Levene Statistic	Df1	Df2	*Sig.*
0,001	1	67	0,976

After testing the homogeneity of the gain data of students' mathematical critical thinking ability, the sig value = 0,976 was obtained, which means sig > 0,05. Based on the results of the homogeneity

test of the gain data, the test decision of the two groups is accepted, which means that the two groups of gain data have the same variance.

Hypothesis Testing

After carrying out the normality and homogeneity test, it is known that the data gain in the experimental class and control class comes from a normally distributed population, and both groups of gain data have the same variance. Furthermore, the equality test of the two means of the gain of critical thinking ability mathematical experimental and control class students using the t-test assisted by SPSS. The results of hypothesis testing of students' mathematical critical thinking ability gain data are presented in Table 6.

Table 6. Recapitulation of Data Normality Test Result Gain Test Result

	Levene's Test for Equality of Variances		*t-test for Equality of Means*			
	F	*Sig.*	t	df	*Sig. (2-tailed)*	*Mean Difference*
Hipotesis Equal variances assumed	0,001	0,976	3,927	67	0,000	16,31

From the calculation results obtained t_{count} = 3,927 and t_{table} = 1,667, because 3,927 > 1,667 then H_0 is rejected and H_1 is accepted. Furthermore, from the t-test output table, it can be seen that the "Mean Difference" value is 16,31. This value shows the difference between the average learning outcomes of experimental class students and the average learning outcomes of control class students, where the average experimental class is higher than the control class. Based on the t-test results, it means that the increase in mathematical critical thinking skills of students who take part in learning by using H5P interactive media is higher than the increase in mathematical critical thinking skills of students who take part in learning without using H5P interactive media.

Achievement of Indicators of Students' Mathematical Critical Thinking

Table 7 presents the achievement of indicators of students' mathematical critical thinking skills before and after participating in learning by using H5P interactive media and learning without using H5P interactive media.

Table 7. Achievement of Indicators of Students' Mathematical Critical Thinking

Indicator	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Interpretation	23%	46%	22%	57%
Analysis	12%	60%	9%	55%
Evaluation	4%	51%	3%	23%
Inference	3%	50%	2%	14%
Average	10,50%	51,75%	9%	37,25%

Table 7 shows that the experimental and control classes experienced increased mathematical critical thinking skills, but the increase in the experimental class was higher than the control class. From the results of the percentage of the final average achievement of indicators of students' mathematical critical thinking skills, it can be concluded that students who take part in learning by using H5P interactive media have higher mathematical critical thinking skills than students who take part in learning without using H5P interactive media.

Discussion

Based on the results of hypothesis testing that has been done, the results show that the increase in mathematical critical thinking skills of students who follow learning using H5P interactive media is higher than the increase in mathematical critical thinking skills of students who follow learning without using H5P interactive media. This is supported by the percentage of achievement of indicators of students' mathematical critical thinking skills; students who follow learning using H5P

interactive media have a higher increase than students who follow learning without using interactive H5P media. This is in line with research conducted by Zulhelmi et al. (2017) which states that interactive media can improve students' critical thinking skills. The average difference in improving students' mathematical critical thinking skills between students who take part in learning using interactive media H5P and students who take part in learning without using interactive media H5P is 13%. This is obtained from the average results of the achievement of indicators of mathematical critical thinking ability of students who follow learning using H5P interactive media reaches a percentage of 41.25%, and for the average results of the achievement of indicators of mathematical critical thinking ability of students who follow learning without using H5P interactive media only reaches 28.25%.

This study shows that using H5P interactive media can improve students' mathematical critical thinking skills, as seen from the average increase in mathematical critical thinking skills. The results of this study are supported by the opinion of Sukmawati et al. (2023), who said that learning by using H5P interactive media features makes learning more meaningful so that it allows students to remember longer; when student memory is high, it can affect better learning outcomes. In addition, Utari (2022) in her research argues that H5P interactive media is proven to make the learning process more active, effective, and meaningful because the features of H5P can help students have an interest in understanding lessons. The features in H5P encourage students to be actively involved in learning; this triggers the students' mathematical critical thinking process in solving mathematical problems. H5P helps students identify errors or improve their understanding. It provides opportunities for students to be active in outline, from interpreting, analyzing, and evaluating to getting the final result in the form of conclusions. Some of these activities are indicators of mathematical critical thinking skills, which include indicators of interpretation, analysis, evaluation, and inference. This means there is a connection between the features of H5P and the indicators of mathematical critical thinking skills.

On the interpretation indicator, the increase in critical thinking ability in mathematics of students who take part in learning without using H5P interactive media is higher than that of students who use H5P interactive media. The percentage difference is 11%, where the class without H5P interactive media is 57%, and the interactive media class is 46%. This is because students who do not use H5P interactive media find it easier to re-present the written editorial to the written of the LKPD. In contrast, students who use H5P interactive media have little difficulty re-presenting visuals and audio to written form. Most students who use H5P interactive media only write some known and questioned points, while students who do not use H5P interactive media write them more completely. According to Ernaida and Yusra (2019), using audio and visual media integrated with print media obtains maximum learning outcomes. However, students must be patient and thorough because they have to go back and forth to turn off the audio to write it into print media or close print media and refocus listening to the audiovisual. This means that the use of audiovisual media takes longer than usual learning. If learning time is limited, it will certainly affect student focus. This makes the percentage of classes without H5P interactive media higher than those with H5P interactive media.

On the analysis indicator, the increase in mathematical critical thinking ability of students who follow learning using H5P interactive media is higher than that of students who do not use H5P interactive media. The percentage difference is 5%, where the class that participates in learning using interactive H5P media is 60%, and the class that participates in learning without interactive H5P media is 55%. Students who follow learning using H5P interactive media excel in making mathematical models of the problems given. This is because the features in the H5P interactive media present problems in the form of interactive videos and worksheets interactive learners that attract students' attention so that students focus while making students directly practice their understanding skills. That way, the analysis indicators in classes that use H5P interactive media are higher than in classes that do not use H5P interactive media. This is in line with the opinion of Vioreza et al. (2022), which states that learning with interactive videos makes students actively involved during the learning process and provides direct experience, making the learning process more fun.

In the evaluation indicator, the mathematical critical thinking ability of students who took part in learning using H5P interactive media experienced a higher increase with a percentage of 51%. In comparison, the percentage of mathematical critical thinking ability of students who took part in learning without using H5P interactive media only reached 23%. This shows that there is a difference of about 28%. In the evaluation indicator, H5P interactive media learning uses one of its features, namely fill in the blank. In this feature, students are asked to answer the questions before proceeding to the next stage. This ensures that students have answered correctly because feedback is given when students answer right or wrong from the questions. The next feature is dragging the word. Drag the word questions allow students to create text expressions with missing parts of text. Students drag the missing text part to the correct place to form a complete expression. This feature can be used to check if the student remembers the text they have read or if they understand something. Other features include drag and drop, single choice, summary, etc. The feedback feature also makes H5P superior because students can find out when they are answering the questions wrong. Ikhwan et al. (2015) argued that the feedback feature is very helpful for students in learning.

In the last indicator, inference, the percentage difference is 36%. The mathematical critical thinking ability of students who take part in learning using H5P interactive media is 50%, and the mathematical critical thinking ability of students who take part in learning without using H5P interactive media only reaches 14%. The stages that exist in the previous indicator, namely evaluation, these stages help students of the H5P interactive media class in achieving the next indicator, namely inference, while students who take part in learning without using H5P interactive media still have much difficulty at the evaluation indicator stage so they cannot achieve the next indicator, namely inference.

When viewed from the overall achievement of each indicator of mathematical critical thinking ability, the interpretation indicator of the class without H5P interactive media is 11% higher than the H5P interactive media class. This is because in using audio visuals, students are required to be more patient and thorough, so it takes longer than usual to learn. If learning time is limited, it will certainly affect student focus. This is what makes the percentage of classes that take part in learning without H5P interactive media higher than classes that take part in learning using H5P interactive media. However, in other indicators, namely analysis, evaluation, and inference, students who take part in learning using H5P interactive media have achievements that are superior to classes that take part in learning without using H5P interactive media. This is a result of the use of interactive media that can facilitate students in understanding the lesson. Students who use H5P interactive media also have higher enthusiasm and are more interested in participating in learning so that they can more easily understand the material of the system of linear equations of two variables. So, H5P interactive media affects students' mathematical critical thinking skills.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the use of H5P interactive media affects the mathematical critical thinking skills of ninth-grade students of SMP Negeri 1 Ketapang odd semester of the 2024/2025 academic year. The effect is indicated by an increase in the mathematical critical thinking ability of students who take part in learning using H5P interactive media is higher than the increase in the mathematical critical thinking ability of students who take part in learning without using H5P interactive media.

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